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UTERINE ACCOMMODATION OF THE PRODUCTS OF CONCEPTION: PHYSIOLOGIC CONSIDERATIONS

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THE size and shape of the gravid uterus is a necessary and primary subject of interest to the obstetrician. So axiomatic is this fact that little thought is given generally to its implications. When it is given consideration, it is usually with respect to the morphology of the uterus, or to the size of the conceptus with respect to the estimated age of pregnancy. One seldom thinks that this phase of obstetrics offers a broad field for fruitful investigation. The recent paper by Ivy⁶ shows that our knowledge is not yet complete with regard to the extent to which the *isthmus uteri* contributes to the uterine wall about the conceptus in the latter part of pregnancy. More recent studies made on infra-primate species suggest that still other attributes of uterine accommodation of the products of conception will bear the attention of clinician and experimenter alike, for these pertain to important physiologic mechanisms that are concerned with fetal growth and welfare. The new data have already yielded conclusions which promise to provide a common basis upon which certain of the functional, and seemingly unrelated, difficulties of late pregnancy may be explained. Uterine accommodation of the products of conception appears to be the common physiologic denominator to these situations. The functional components of uterine accommodation include, (1) the hemodynamic conditions of the flow of maternal blood in the uterine wall; (2) the hydrostatic relations involved; (3) the problem of uterine growth; (4) the extent to which the observations thus far made apply to other species and to other types of uteri; and finally, (5) the relation of the foregoing considerations to fetal growth and to fetal and maternal welfare.

Uterine Circulation and the Shape of the Conceptus

Despite its obvious importance, the question of maternal blood flow through the uterus has been little studied (cf. Reynolds⁸). Observations by Barcroft,

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Herkel, and Hill¹ pertain to the total blood flow through the whole organ of litter-bearing animals. Such determinations neglect the fact that the uterine tissues about the distended spheroidal conceptuses during the middle period of pregnancy (in litter-bearing animals) are subjected to ever-increasing tension resulting from continued growth of the conceptus. On the other hand, those parts of the uterus lying between the implantation sites are subjected to less tension. This favors a channeling of blood through such areas in preference to those parts that are under greater local tension. Blood flow measurements for the entire organ fail to reflect such local differences in the circulation. It was for this reason that a special study was initiated. This has been reported in detail in a physiologic journal (Reynolds²). Consequently, only the essential conclusions of that study need be repeated here.

In approaching the problem of differential circulation rates within the uterus, it was essential to have a method which was highly localized. It mattered little that blood flow rates in metric or any other units were not obtained. Relative rates of flow were important. The method adopted possessed these characteristics, yielding a measure of blood flow through small vascular beds. This was accomplished by injection of small volumes of sodium cyanide into the venous system of the uterus and elsewhere, and measuring the time required for the cyanide to be carried from the site of injection by blood from anastomosing vessels into the systemic circulation and to the carotid body of the mother. Calculation of the reciprocal of the circulation time yields a coefficient of the rate of blood flow. Employing this technique, blood flow rates have been compared in different parts of the vascular tree at selected times in pregnancy. In the uterus, injection was made into the lateral uterine vein in any of several locations. These were: at the site of maximum distention of the uterus about a conceptus; at interimplantation sites; in the lateral uterine veins of nonpregnant uteri of unilaterally sterilized rabbits. In addition, circulation times were measured from the femoral vein to the carotid body, in order to evaluate the blood flow rate in the systemic circulation of the mother.

The essential features of the local circulation of maternal blood in pregnant rabbits is shown in curve A of Fig. 1. Here, blood flow rates at different periods of pregnancy are shown as a percentage of the prepregnancy blood flow rate. It will be seen that there is a gradual and progressive decrease until the twentieth day, to 68 per cent of the prepregnancy level. Upon attainment of maximum spherical size (about the twenty-second day) there is a profound and sudden decrease in circulation rate to a quarter of the prepregnancy level. Clearly, a critical condition develops with respect to the local uterine circulation about the conceptus at the beginning of the last trimester of gestation in the rabbit. The condition does not last for long, however. At this point, the conceptus undergoes elongation, and with this, there is an immediate restoration of the local blood flow to a relatively high level. It is 75 per cent of the prepregnancy circulation rate, or about equal to that which is found on the twelfth day of pregnancy, early in the period of spherical growth of the conceptus.

The situation described for the local circulation about the conceptus is not paralleled by that in any of the other parts of the vascular tree for which blood

flow rates have been determined. The circulation rate in nongravid cornua of unilateral pregnancies in rabbits shows no change before the twenty-eighth day. The systemic circulation rate, as judged by femoral-carotid circulation times, diminishes slightly but significantly during the first half of gestation. It then increases to a maximum on the twenty-second day at the time of greatest difficulty with respect to the uterine circulation about the conceptuses. The increase in systemic circulation rate—which may be a compensatory homeostatic response on the part of the maternal organism—is inadequate to overcome the critical local condition which attainment of maximal spheroidal size brings about in the uterus. What conditions, one asks, govern the local circulatory efficiency of maternal blood flow in the uterus?

Change in Shape of the Conceptus During Pregnancy

In Fig. 1, curve *B*, the relative shapes and sizes of the conceptus sites in the gravid uterus are shown for certain periods of pregnancy. Several interesting features of these changes should be noted in order to appreciate the local circulatory conditions outlined above.

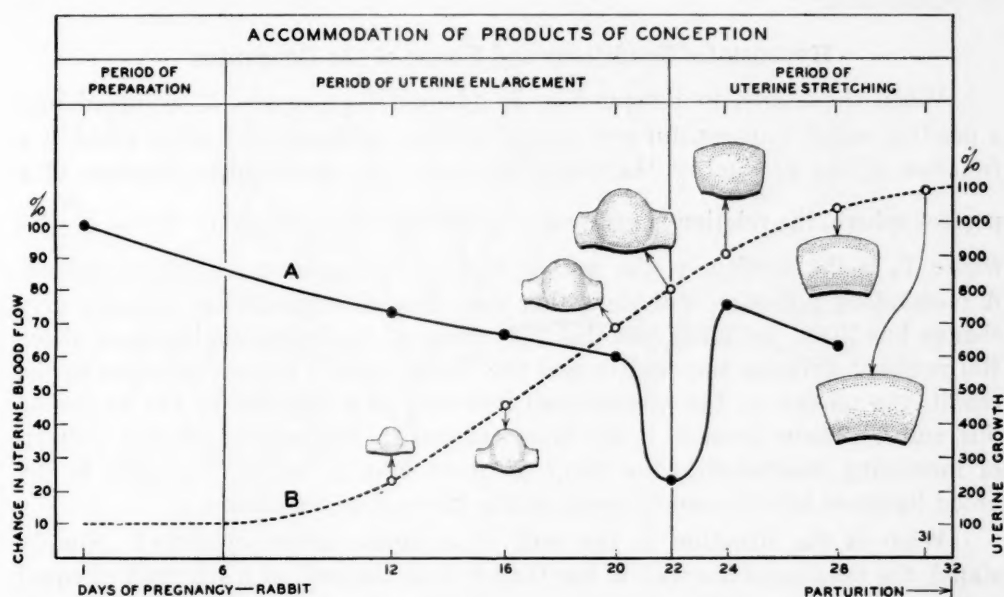


Fig. 1.—Uterine accommodation of the conceptus in the rabbit. Curve *A*, local blood flow through the lateral uterine vein in the uterine wall. Curve *B*, increase in weight of the uterus during pregnancy, showing the relative size and shape of the conceptus at different times. See text for discussion of the significance of conversion of the conceptus from spheroid to cylindrical shape.

First, throughout the period when the conceptus possesses a spherical shape, the circulation rate of maternal blood through the uterus decreases. Second, the blood flow diminishes as the size of the spheroid conceptus increases. Third, after the spheroid loses its spherical shape, the circulation of maternal blood about the conceptus is restored to a comparatively high level. Clearly, this elongation of the conceptus after temporary embarrassment of the local circulation is associated with relief of resistance to the flow of maternal blood through the greatly distended uterus.

There is more direct evidence that the shape, and not mere distention, plays a determining role in affecting the maternal blood flow locally. This was obtained when observations were made upon three uteri on the twenty-second day of gestation. Some of the fetuses had undergone elongation. Others were still in the spherical state (see Fig. 2). The blood flow rates were measured in each type of conceptus. The effective head of arterial blood pressure and the place in the vascular tree was comparable for each type of conceptus site. In spite of this, the blood flow rate through the spherically distended uterus was exceedingly slow, whereas at the elongated conceptus sites, the circulation rate was at a significantly higher level (Reynolds⁹). The conclusion therefore follows that the shape of the distending conceptus is the principal local determiner of the efficiency of the local vascular system. The physical nature of these local conditions, particularly of shape, has been a subject of a separate study (Reynolds¹⁰). The argument resolves itself into a general discussion of the hydrostatic forces involved in hollow elastic bodies as described by Hess⁴ for the cardiovascular system and as shown to be generally applicable to hollow viscera by Sutherland.¹⁵

Hydrostatic Conditions and Shape of the Conceptus

When the uterus is distended by a spheroidal conceptus, it is forced into a position which imposes, for any unit of surface, a degree of tension *which is a function of the product of the respective radii*. In the simplest situation of a perfect sphere, the relation is expressed by the following equation: $T_s = \frac{r^2 \cdot p}{2}$ where T_s is the tension; r , the radius; and p , the pressure within the sphere. A moment of reflection will show that even though intrauterine pressure may change but little, the mere fact that the radius of the spheroids increases about 100 per cent between the twelfth and the twenty-second day of gestation in the rabbit, the tension in the uterine wall increases *as a function of the square of this value*. Tissue tension, it has been suggested (Reynolds⁹), offers a pattern of increasing resistance to the entry of blood from the uterine arteries in the broad ligament into the small vessels within the wall of the uterus.

What is the situation in the wall of a hollow elastic cylinder? Simply stated, the tension in the wall is less than it is in the wall of a spheroid of equal radius and pressure. Moreover, there are two tension components, not one as in the sphere. In a circular direction, the tension is a function of the product of the radius and the pressure ($T_c = r \cdot p$). In a longitudinal direction, it is one half this ($T_l = \frac{r \cdot p}{2}$).

The process of elongation of the uterus may be regarded, therefore, as a mechanism which serves to relieve the hydrostatic tension on the uterine wall, thus permitting restoration of the flow of maternal blood in the uterus about the conceptus. At the same time, this change permits rapid enlargement of the fetus during the last trimester of pregnancy with minimal increase in average uterine wall tension, at least until near term. Consequently, the pattern of ten-

sion within the uterine wall is governed largely by the shape and size of its contents. The relation of this pattern of tissue tension to the local flow of blood within the uterine wall is discussed in the previous section, above. There is reason to believe that this relation may bear a causal relation to other aspects of uterine function as well, especially in so far as the growth of uterine tissues in pregnancy is concerned. This has been reviewed in a previous publication (Reynolds¹⁰) so the results of that study may be summarized briefly.

Uterine Growth and the Shape of the Conceptus

The curve of uterine enlargement during pregnancy in the rabbit is shown in Curve *B* of Fig. 1. The shape of this curve is characteristic of growth curves in general in that it is sigmoid. Clearly, the stimulus for uterine enlargement does not exist until after the first week of gestation in the rabbit; it then continues effectively throughout the entire period during which the conceptuses are spheroidal. The stimulus diminishes as soon as the conceptuses merge, or grow sufficiently to form cylinders.

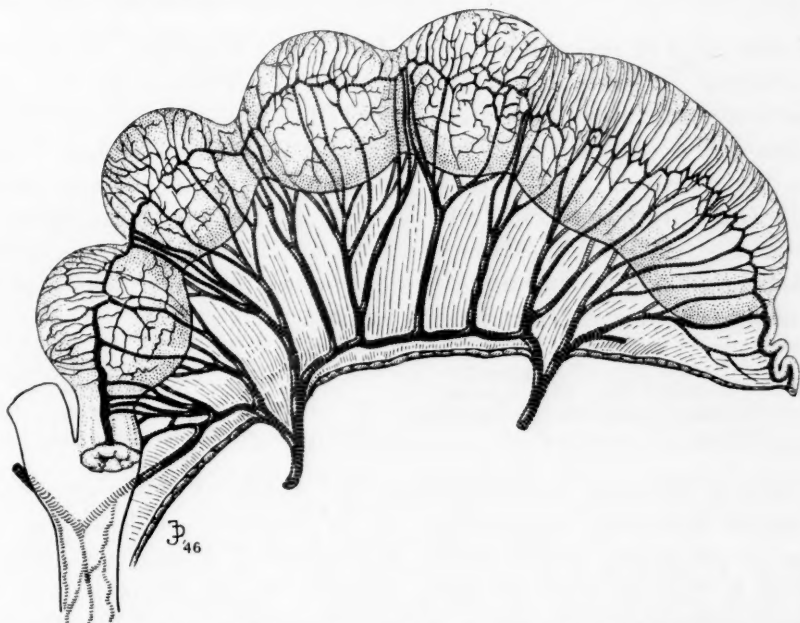


Fig. 2.—Drawing of a freshly fixed uterus of a rabbit on the twenty-second day of pregnancy (two-thirds of the duration of pregnancy) in the process of conversion of the conceptus from spheres to cylinders. See text for discussion of the results of the measurement of blood flow through the uterus about the two types of conceptus shown, and with respect to rearrangement of the vascular architecture. Drawn by Mr. James F. Didusch.

The nature of the growth factors which operate at this time have been reviewed (Reynolds^{7, 8, 10}). In brief, the initial period of the uterine growth curve, before extensive enlargement, is a period of hyperplasia both of endometrial elements and of myometrial elements (progestational proliferation). It is characterized, accordingly, by an increase in the number of cellular units which are available for subsequent hypertrophy as well as by preparation of the endometrium for implantation of the blastocysts.

Soon after implantation, uterine distention begins as a result of the growth of the trophoblast and its associated structures, and from distention from the accumulation of fluid within the conceptus. Distention in a spheroidal shape creates, as we have seen, the maximum local tension within the uterine wall. It is interesting to observe in this connection that *tension* is one of the most effective stimuli favoring uterine growth (Reynolds,^{7, 8} Reynolds and Kaminester¹²). The role of tension as a stimulus of uterine growth is demonstrated by two types of observation. First, when one uterus of a rabbit is rendered sterile by prior ligation of the Fallopian tube, that non gravid uterus does not increase in size appreciably throughout the first two-thirds of pregnancy in the opposite uterus. The non gravid uterus lacks the stimulus of distention, although its hormonal supply is similar to that of the contralateral growing and distended uterus. Second, distention of the uterus of untreated castrated rabbits evokes a uterine growth response (Reynolds and Kaminester¹²). Thus, we see, the spheroidal conceptus in pregnancy may elicit its own growth of the uterus through local distention, and for this the conceptus possesses a most effective shape.

The last third of pregnancy brings about a new situation. With elongation of the conceptus, the rate of growth of the uterus becomes much less and there is, at the same time, as we have seen, a marked decrease in the tension to which the uterine wall is subjected. It is at just this time that full flow of maternal blood to the uterus is re-established and the fetus commences to grow most rapidly. This correlation with fetal growth is shown by data pertaining to the size of the fetal rabbit (Hammond³). Under rigid conditions designed to minimize genetic and random influences, the weight of rabbit fetuses at selected periods of pregnancy was determined as follows:

Sixteenth day of pregnancy	0.58 Gm.
Twentieth day of pregnancy	2.96 Gm.
Twenty-fourth day of pregnancy	13.42 Gm.
Birth (thirty-second day of pregnancy)	70.00 Gm.

Here, it will be observed, there is marked fetal growth at a time when the uterus is no longer enlarging appreciably. It is therefore evident that the last trimester of pregnancy in the rabbit is a period of uterine stretching. This consists of a "paying out" of tissue elements which are laid down by pre-gestational proliferation during a period of preparation of the uterus in the earliest part of pregnancy and which increase in size by hypertrophy during the period of most rapid uterine growth.

It is worth emphasizing again that stretching of the uterus in the last trimester is accomplished under circumstances which impose least tension upon the uterine tissues, and which interfere least with the local circulation of blood to the conceptus. In this way, there is a nice integration of structural and functional factors which operate throughout the entire period of gestation. Taken together, these provide the mechanism of uterine accommodation of the products of conception. The key to this mechanism is found to be the *shape* of the products of conception although other factors relating to hormonal conditions,

to the size of the conceptus, and so forth, contribute to the effect which change in shape of the conceptus will have upon the uterus.

Shape of the Conceptus and Rearrangement of the Uterine Blood Vessels

The fact that change in shape and increase in size of the conceptus affects the circulation of blood locally through changes in tension on the uterine wall suggests that an investigation of the re-orientation of the vascular bed during gestation should prove fruitful. Such a study has been started, and will be reported separately elsewhere. Enough has been learned, however, to indicate the essential features of this adjustment.

The methods of studying this were twofold. First, diffusible salts (potassium ferrocyanide and iron ammonium citrate) were injected caudally below the renal artery into the aorta under a pressure of 110 millimeters of mercury. The excised uterus was then immersed in acid, and the tissues became colored by deposition of Prussian blue wherever the salts had penetrated the tissues. This, of course, was governed by the patency of the vessels at the time of injection. Second, injection-corrosion preparations were made of the uterus after injection of vinylacetate into the blood vessels. Red was used for arteries and blue for veins. After digesting away the soft tissues, the pattern of the larger blood vessels of the uterus could be seen readily. This method was used in the injection of the spiral artery recently reported to be in the hilus of the ovary (Reynolds¹¹).

The injection of diffusible dye shows that it is distributed uniformly throughout the uterus, both about the conceptuses and between them, through the sixteenth day of pregnancy. By the twentieth day, however, the regions about the conceptuses are paler than the adjacent areas. By the twenty-second day, the dye is virtually absent from the region of distention *if the conceptus is spheroidal*. In those instances in which conversion to the elongated or cylindrical form has taken place by the twenty-second day, the dye is found in increasing concentration in the uterine tissues over the conceptus. These data parallel the circulation-rate data summarized above. Taken together, they comprise physiologic and morphologic evidence of the effect of hydrostatic forces upon the patency of the small blood vessels of the uterus.

The vascular tree in the injection-corrosion preparations shows in a different manner the effect of hydrostatic forces upon the vascular architecture in the uterine wall about the conceptus sites. For example, in addition to an increase in size of all of these vessels, there are profound alterations in their distribution. It was found that an increase in spheroidal size of the conceptus serves to force the larger blood vessels within the uterine wall to each end of the conceptus, with resulting extension of the remaining blood vessels within the wall of the uterus. Conversion of the sphere to an elongated cylinder, however, permits a re-grouping of the blood vessels which have been forced to the inter-implantation sites, so that they become more evenly spaced along the lateral wall of the cylinder. This is shown in a drawing (Fig. 2) which was made of a freshly fixed specimen obtained on the twenty-second day of pregnancy. This rabbit had been used for circulation rate studies. The blood flow through the veins of the

spheroidal conceptuses (the second from the cervix was used) was extremely sluggish. The circulation rate through the elongated cylindrical conceptuses was rapid, however.

It is believed that the process of conversion from spheroid to cylinder is very rapid. The basis for this belief lies in the fact that all the conceptuses in a uterus usually are of one type or of the other. Only rarely is the situation shown in Fig. 2 seen. It follows, accordingly, that when the situation becomes critical with respect to the local flow of maternal blood, a rapid readjustment is usually made. If it were not, then the welfare of the fetus might be jeopardized. Evidence has been adduced elsewhere to show that in the rabbit the onset of the incidence of fetal death (determined by gross fetal resorption) in late pregnancy coincides with this period of conversion of the conceptus from spheroid to cylinder.

So much for the structural and functional factors involved in the mechanism of uterine accommodation of the products of conception. What has been said pertains to the rabbit which has a uterus duplex. Is there any evidence that these special conditions have a counterpart in other species possessing a *uterus duplex*, and in those having a *uterus bicornis* and a *uterus simplex*?

Comparative Aspects of the Mechanism of Uterine Accommodation

Since direct observations pertaining to uterine accommodation have been made solely in the rabbit, there is indirect evidence only that they have a counterpart in other species. We must rely upon a few scattered data pertaining to the form of the uterine growth curve and to the dimensions and thickness of the uterus at different periods of pregnancy. Even so, there is telling proof that what has been described in some detail for the rabbit is true also for other species with similar and with other forms of uteri. There are differences in some with respect to the time of conversion and in others in the pattern of conversion. But so far as existing data go, there is no known exception to the general principle that accommodation of the products of conception by the uterus is locally controlled by the shape of the conceptus.

Uterus duplex.—The curve of uterine growth in the rat appears to have been determined first by Siegmund¹³ (summarized in Reynolds⁸). It was found that the growth curve is sigmoid, as in the rabbit, with the stimulus for rapid uterine growth awaiting implantation of the blastocysts. The point of diminishing uterine growth comparable to that in the rabbit takes place about the eighteenth day of pregnancy. This is only three days before parturition in this species. The inflection in the uterine growth curve in the rat is coincident with conversion from spheroid to cylindrical shape of the conceptus (unpublished data of Dr. Philip Rogers, personal communication, and L. T. Bradin, personal communication). Except, therefore, for the shorter proportion of pregnancy during which the fetuses are in the cylindrically shaped uterus, the situation appears to be entirely comparable to that which has been observed in the rabbit. This constitutes the extent of detailed information of the growth and conversion of the uterus duplex in the latter part of pregnancy, with the exception of several observations which have been made on the golden hamster in this laboratory. In this species pregnancy lasts but sixteen days. The conceptuses have been seen to be spheroidal on the fifteenth day. Conversion would seem to be closely asso-

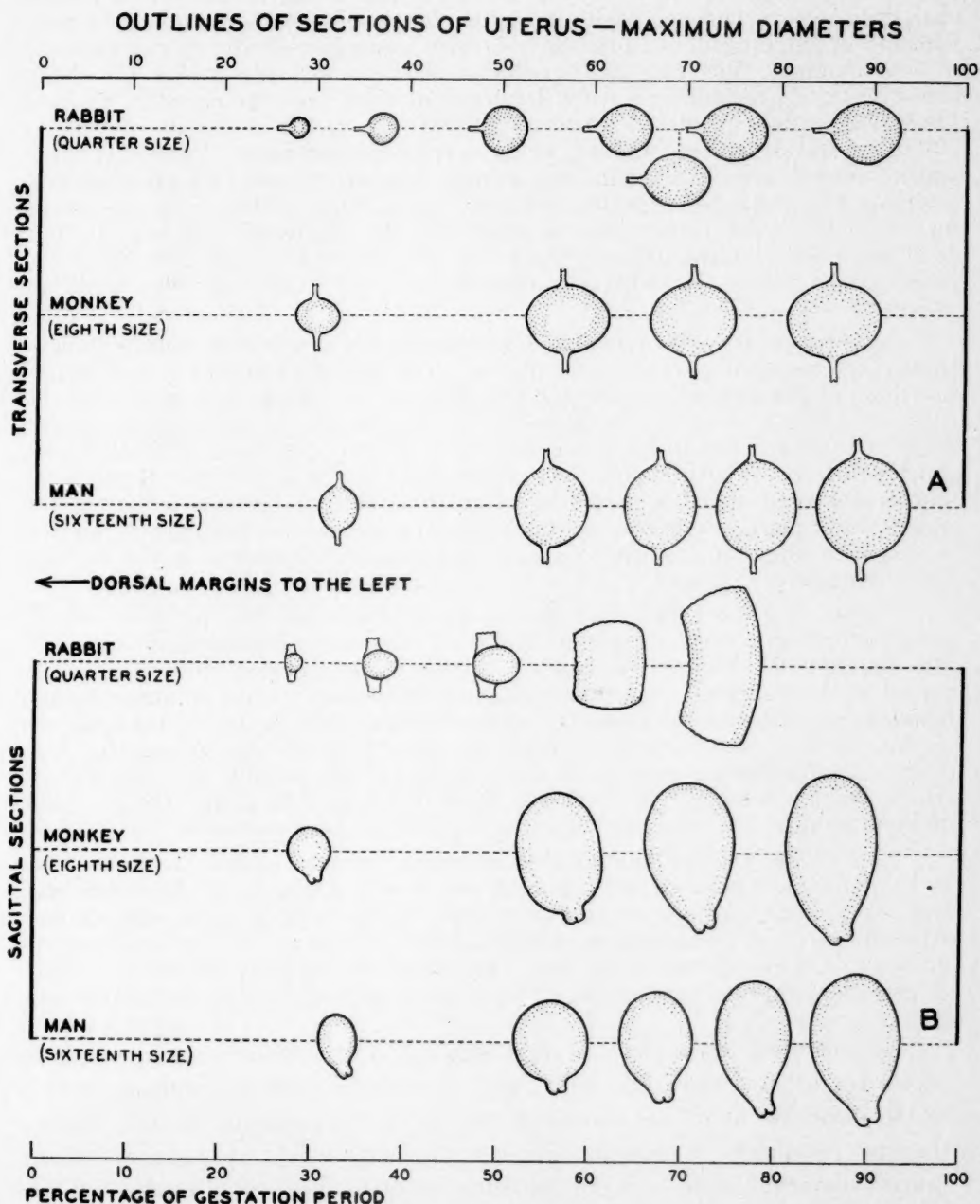


Fig. 3.—Comparison of transverse (top) and sagittal (bottom) outlines of the uteri of the rabbit, monkey, and human being (at different periods of pregnancy). Drawn to a scale of 1, $\frac{1}{2}$ and $\frac{1}{4}$ for rabbit, monkey, and human being respectively. Dorsal aspect of uterus to the left, ventral to the right. Note three-dimensional growth of the conceptus through the first two-thirds of pregnancy. In the last trimester, growth of the conceptus during "elongation" is uni-dimensional in the rabbit and monkey, but bi-dimensional in the human. See text for discussion of the significance of no appreciable change in the dorsoventral measurement of all three in the last third of pregnancy in maintaining a nearly fixed curvature to the lateral margins of the uterus.

ciated with parturition in this form. If so, it may be more than a coincidence that the newborn hamster which is in the elongating uterus for less than one-fifteenth of the duration of pregnancy is born in an exceedingly immature state of development. The rat, which remains in the elongating uterus for about one-seventh of pregnancy, is more developed at birth than the hamster, whereas the rabbit, which spends one-third of its fetal life in the elongating uterus, is still more advanced than the rat in its development at birth. Markedly post-mature fetuses are obtained in both rabbits (Snyder¹⁴) and rats (Hooper⁵) if pregnancy is prolonged experimentally by several days. Perhaps the statement may be made, when more is known regarding this suggested relationship, that *fetal maturity at birth depends upon the proportion of pregnancy which the fetus spends under the optimal conditions for fetal growth in the elongating uterus.*

Uterus Bicornis.—We have little information on the curve of uterine growth in any species having this type of uterus. The only data known to this writer are those of Hammond² for the cow (cf. Reynolds⁸). These data show that the uterus exhibits a sigmoid growth curve. Noticeable uterine enlargement begins about the second month of pregnancy, and continues at an accelerating rate until about the seventh month. After this, there is, as in the case of the other species discussed above, a period in which little further increase in size of the uterus takes place. Nevertheless, the fetus increases in size from about thirteen or fourteen kilograms to twenty-six or twenty-seven kilograms during the last two months of pregnancy.

Uterus Simplex.—The data which are available for the purposes of the present discussion with respect to this type of uterus are exceedingly limited. Dr. Elizabeth M. Ramsey has made available for study four monkey uteri obtained at very carefully selected periods of pregnancy. Data from the human being have been secured from the measurements cited by Ivy,⁶ and from the section by Prof. Rosthorn in v. Winckels' *Handbuch der Geburtshilfe*.¹⁶ In addition, reference has been made to limited materials suitable for such a study which are available in the Carnegie Embryological Collection. On the basis of these studies, the relations shown in Fig. 3 have been tentatively established.

In Fig. 3a, the outlines of the *transverse sections* of the monkey uterus at the point of maximum measurement are shown in a scale of one-eighth size, and the similar outlines are shown for the human uterus in a scale of one-sixteenth size. For comparison, similar outlines are shown for the rabbit uterus drawn to a scale of one-fourth size. All are shown at their respective periods of gestation, expressing the total duration of pregnancy in each as 100 per cent.

In compiling these data, several striking relationships were apparent at once. In the first place, the rabbit and the monkey possess a common pattern in the development of the transverse outline of the pregnant uterus. During the first two-thirds of gestation, there is an increase in transverse and dorsoventral diameters alike. In the last third of pregnancy, the increase in either of these diameters is very small, at least until just before term. The condition in the human was observed to be quite different and this difference was consistently noted regardless of which source of material was consulted. Up to the last third of gestation (in the sixth lunar month) there is a progressive increase in dorsoventral and lateral diameters, as in the rabbit, and monkey. After the sixth month the lateral dimension of the uterus continues to increase while the dorsoventral diameter changes relatively little until just before term. Clearly,

the condition is not like that found in the rabbit and in the monkey. We shall return to this point later in discussing the significance of these different relationships.

In Fig. 3b, the sagittal outline of the uterus of the rabbit, the monkey, and the human being are shown in the same proportions as in Fig. 3a for different periods of pregnancy. It will be seen that there is elongation of the uterus in every case, particularly during the last trimester of gestation. Thus the period of elongation, in contrast to the period of growth in all dimensions, is characteristic for the three species, with the added fact that in the human being there is growth in the lateral dimension during this period also. Of what significance is it that in the rabbit and monkey there is no important change in any of the transverse measurements of the uterus during the last period of elongation, whereas in the human only the dorsoventral diameter remains relatively constant?

The answer to the foregoing question is not known. It may be argued with reason, however, that in one very fundamental respect there is a point of similarity between the three types of uteri shown in Fig. 3. It is that there is a relationship between the tension within the uterine tissues and the radius of curvature of the uterus, as pointed out in a previous section above. In the human, the dorsoventral dimension does not increase perceptibly during the period of uterine stretching, with the result that elongation in this uterus involves a two-dimensional change with preservation of the curvature of the lateral margin of the uterus. In the monkey and the rabbit, elongation of the products of conception is unidimensional, so that here, too, the radius of curvature of the lateral margin of the uterus is preserved during this period with little or no alteration. Inasmuch, then, as the radius of curvature of the lateral margins of the uterus does not change perceptibly during the period of uterine elongation in any of the three kinds of uteri considered, *this is the essential structural feature in common between these three types of uteri during the period of uterine stretching.* This part of the uterus is the region of entry and of exit of the large blood vessels of the uterus in each of the types of uteri discussed. It is this region, accordingly, which is subjected to least stress with rapid fetal growth after conversion of the conceptus from spheroid to something approximating cylindrical shape.

Uterine Accommodation and Maternal and Fetal Welfare

Attention of investigators may be directed with profit in the future to the characteristics of a proper conversion of the human uterus from ovoid to cylindrical (or pyriform) shape at the beginning of the last trimester of pregnancy. Certainly there are good experimental grounds for suspecting that unusually prolonged or unusually profound ischemia of the maternal circulation in the uterus at this time could produce changes which are either detrimental to, or totally destructive of, the fetus. In the rabbit a relationship has been pointed out already between the incidence of fetal resorption (Reynolds¹⁰ and conversion of the uterus at the beginning of the last third of gestation. In this litter-bearing animal, each conceptus normally survives or dies independently of

the others. It may be that in the uterus simplex the situation is more complicated. Uterine ischemia of given degree or duration may bring harm to the maternal organism by giving rise to toxic manifestations, or it may give rise to local conditions which jeopardize the continuance of pregnancy or the viability of the fetus.

Summary

1. This paper offers a general discussion of the physiologic mechanisms of uterine accommodation of the products of conception. It summarizes recent experimental and basic considerations of the subject published in other journals with respect to infra-primate species, and it includes reference to the readjustments that take place in the arrangement of the blood vessels of the uterus. The features of uterine accommodation discussed are:

(1) *Uterine circulation.* It is shown that the local circulation of maternal blood in the uterus decreases gradually as the conceptus increases in size. Suddenly, as the conceptus reaches maximum ovoid size, a profound transitory decrease in uterine circulation (i.e., uterine ischemia) takes place. The conceptus changes shape abruptly (by elongation) and with this, there is restoration of a rapid circulation of maternal blood through the uterus. (2) *Hydrostatic forces* in the uterus. It is shown that the existence of an ovoid shape with respect to the conceptus imparts a relatively high degree of tension about the conceptus, even though intrauterine pressure is relatively low. The radii increase rapidly in three dimensions at this time and local tissue tension increases in *geometric* proportion. With elongation, there is an abrupt decrease in tissue tension, so that further increase in size of the conceptus evokes an increase in local tension in *linear* rather than geometric proportion. (3) *Uterine growth.* In pregnancy, hypertrophy of uterine tissues is associated with uterine distention by an ovoid conceptus. Consequently, it takes place at the time of maximum uterine tension. After elongation of the products of conception, uterine growth decreases sharply, and at this time there is the least possible increment in uterine tension with fetal growth. The last trimester of pregnancy (when fetal growth is most rapid) consists of "paying out" tissue elements which increase first by hyperplasia and then undergo hypertrophy in earlier periods of pregnancy. (4) *Vascular architecture of the uterus.* This is shown to change in such a way that the uterine ischemia which develops, with its ensuing relief, follows a pattern which may be explained on the basis of the local hydrostatic forces noted above. (5) *Comparative aspects of uterine accommodation* are discussed. This is a subject necessitating extensive study. Nevertheless, there is reason to believe that the *uterus duplex*, the *uterus bicornis*, and the *uterus simplex* all manifest the various essential characteristics of uterine accommodation described in this paper. The situation in the monkey more nearly resembles that in the rabbit than it does that in the human being. All three, however, have in common the fact that during the phase of principal elongation of the uterus, conditions are such that local tension of the tissues about the region of entry and exit of the uterine blood vessels is held to the lowest possible level compatible with rapid enlargement of the fetus. (6) Since

transitory uterine ischemia is a necessary concomitant of conversion of the conceptus from an ovoid to a cylindrical shape, the possible consequences of abnormal manifestations of this on the welfare of the maternal organism, of the fetus, or both is suggested.

2. The essential application of this discussion to practical obstetrics is that it emphasizes the physiologic basis of proper change in shape of the uterus for normal pregnancy particularly about the beginning of the last trimester of pregnancy.

References

1. Barcroft, J., Herkel, W., and Hill, S.: *J. Physiol.* **77**: 194, 1933.
2. Hammond, J.: *The Physiology of Pregnancy in the Cow*, Cambridge, 1927, Cambridge University Press.
3. Hammond, J.: *Trans. Dyn. of Development (Russian)* **10**: 93, 1935.
4. Hess, W. R.: In Bethes' *Handbuch der Normalen und Pathologischen Physiologie*, VII/2:899, 1928.
5. Hooper, E. C.: *Proc. Soc. Exper. Biol. & Med.* **31**: 1115, 1934.
6. Ivy, A. C.: *AM. J. OBST. & GYNEC.* **44**: 952, 1942.
7. Reynolds, S. R. M.: *Symp. Quant. Biol.* **5**: 84, 1936.
8. Reynolds, S. R. M.: *Physiology of the Uterus*, New York and London, 1939, Paul B. Hoeber.
9. Reynolds, S. R. M.: *Am. J. Physiol.* **148**: 77, 1947.
10. Reynolds, S. R. M.: *Anat. Record* **95**: 283, 1946.
11. Reynolds, S. R. M.: *AM. J. OBST. & GYNEC.* **53**: 221, 1947.
12. Reynolds, S. R. M., and S. Kaminester: *Am. J. Physiol.* **116**: 510, 1936.
13. Siegmund, H.: *Arch. f. Gynäk.* **140**: 583, 1930.
14. Snyder, F. F.: *Bull. Johns Hopkins Hosp.* **54**: 1, 1934.
15. Sutherland, W.: *Proc. Roy. Soc.* **2B 81**: 497, 1909.
16. v. Winckel, F.: *Handbuch der Geburtshülfe*, Wiesbaden, 1903, J. F. Bergman, vol. 1.

THE PROBLEM OF THE REPEAT CESAREAN SECTION— A PRELIMINARY STUDY

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A PRECISE knowledge of the maternal risk in repeated sections is lacking. True, there is no scarcity of opinions, but generally these are mere statements of personal beliefs, or, when supported by evidence, the experience on close examination hardly warrants the broad conclusions drawn. That there is a cumulative risk in repeat sections is believed by Adair,^{1, 2} Gordon and Rosenthal,³ Hawks,⁴ DeLee,⁵ and Orenge.⁶ Sometimes contrary opinions are expressed. Thus Bride,⁷ Arnott,⁸ Barrett,⁹ and Berkeley¹⁰ believe that there is no increased risk. Recently Dieckmann and Daily¹¹ remarked: "Most statistics indicate that the elective repeat cesarean section has a lower mortality than that of the primary operation." This is generally true if one compares the elective repeat low section with the primary operation where cases in labor are included. But comparisons of elective repeat with elective primary for disproportion reveal that the former has a much higher mortality. Thus, in the preparation of Table I, 7,106 cesareans (the total of both primary and repeat) showed a mortality of 2.9 per cent as compared with 3.2 per cent for the repeat sections alone. An attempt to arrive at a true knowledge of the risk of repeat section should involve a detailed study of individual experiences large enough to reduce the element of chance in statistical reports to a negligible quantity. Mass statistics are not only undependable, but frequently downright misleading. Bourne¹² and Schumann¹³ stress the weakness of mass statistics and surveys. But the true Achilles' heel of these mass surveys is not always a prejudiced or hasty or careless interpretation, but is often, and in fact usually, the large number of scanty, unintelligent, and sometimes evasive case histories, incomplete from so many viewpoints that they are quite inadequate material on which to base a proper interpretation. The mere quotation of mass statistics is a poor substitute for individual experience and the use of intelligence and judgment.

In this paper, with one exception, only the experiences of individual men or individual hospitals is presented, and an effort is made to assess the various factors which are believed today to enter into the risk of repeat section. After "the consideration and inference of individual results"¹² and an assessment of the present-day mortality of the repeat operation, a way to reduce this risk will be offered. The factors which enter into this mortality will be pointed out in two ways: (1) by conclusions of individual hospital studies, and (2) by a demonstration of additional factors generally believed to enter into the mor-

tality, but not stressed in the original papers. All of the papers whose results are summarized in Table I deal with sections as a whole and repeat cesareans, but for a few notable exceptions immediately to be mentioned, receive only cursory attention.

Table I includes these exceptions. Smith¹⁴ found that the mortality of primary section for uncomplicated disproportion or cervical dystocia was about 1 per cent in his series, whereas the risk of the repeat sections was 3.4 per cent. He stated: "It is difficult to say what the factor may be that makes repeat section a greater risk than primary section for uncomplicated disproportion." He pointed out that organic diseases such as rheumatic heart disease, nephrosclerosis, and the like, did not account for the difference. He found that "shock and hemorrhage—are a conspicuous cause of death in the group of repeat sections." (It is important to state here that his study and those immediately to be mentioned deal with classical sections.) Fraser and Sparling¹⁵ agree with Smith. Hawks⁴ and Matthews and Acken¹⁶ also agree with the aforementioned. At first thought it might seem that the operative era of the cases in Table I was one in which a technique comparable with the present-day practice had not developed, but a careful analysis reveals that this is not true in the series of the Jewish Hospital of Brooklyn,¹⁷ the Nursery and Child's Hospital,⁴ and the Johns Hopkins Hospital review.¹⁸

A glance at the details of fatal cases shows that occasionally, as was the not infrequent habit from 1918 to 1928 or thereabouts, the patient was allowed to have a short period of labor. Occasionally also, the membranes had been ruptured four to six hours. These two factors increase the risk of peritonitis or septicemia. Ether was the commonly used anesthetic. The present extensive use of local, single, or fractional spinal, and pentothal with or without local, is a proof of the desire to get away from ether. The common occurrence of shock and hemorrhage is to some extent due to general anesthetics. They are much less common with local or spinal anesthesia. Occasionally death occurred from peritonitis, and various forms of tubal sterilization had been performed. No doubt in many other fatalities sterilization was performed, although it is not always recorded in the sometimes scanty summaries. Rupture of the classical uterine scar and adhesions become progressively more threatening with each operation. Generally, the studies neglect to state how many previous sections had been performed. However, enough data is given to enable one to conclude, together with one's knowledge of the almost universal practice of sterilization at the second or third section, that most of the sections were second sections, a few tertiary, and practically none beyond this. Thus, of 662 repeats, 553 were second sections, and only 66 were third sections. Only Smith's¹⁴ series differed. Here, of 643 sections, 446 were second sections, and 197 third or more.

Table I indicates that repeat classical section is a dangerous procedure. No doubt the mortality is lower than 3 per cent if the operation is performed electively before rupture of the membranes and doubtless, too, the avoidance of general anesthesia will reduce the incidence of hemorrhage. It is obvious too that the sulfonamides and penicillin, and the more liberal and precise use of transfusions will materially lower the mortality. On the other hand no one knows what is the frequency of rupture of the uterus at the third or fourth section and its mortality, nor has the danger of adhesions ever been reported in a similar large series of repeat sections. There is every reason to believe, however, that following the classical technique, rupture and adhesions are just as dangerous today as ten or twenty years ago. Moreover, in the truly repeat operation (third section or more) certain constitutional factors be-

TABLE I

NAME	HOSPITAL	YEAR	TOTAL REPEATS	NO. DEATHS (all classi- cals)	PERCENT DEATHS (4% of classicals done)	TOTAL NO. SECTIONS	DETAILS OF FATAL CASES
H. B. Matthews and A. S. Acken, Jr.	Methodist Brooklyn	1920 to 1938	330 301=2nd 9 deaths 22=3rd 2 deaths 7=4th 0 deaths 254 classicals	11	3.3 (4% of classicals done)	1,066 total % deaths 3.2	1 + 2=cardiac deaths 3 + 4=pulmonary embolus 5=hemorrhage 6=sepsis 7 + 8=intestinal paresis 9, 10 + 11=intestinal obstruction 3 also had ruptured uterus
K. M. Wilson	Johns Hopkins	1902 to 1925	88 69 patients 52=2nd 15=3rd 2=4th	3	3.4		1 hemorrhage—? type 2 peritonitis—1906—classical late in second stage 3 peritonitis—intestinal injury from freeing adhesions
R. W. Mohler	Philadelphia Lying-In	1932 to 1942	299 (Sterilization at 2nd section as a policy)	5	1.7	1,322 949 classic 256=Kerr 68=Beck total % deaths 1.37	G-O-E anesthetics 1 Aet 29—1 previous classical section—pul- monary embolus 15 days p.o.—4 hours of labor 2 Aet 24—shock during op.—probably from anesthetic 3 1 previous section—shock + hemorrhage at op. 4 Aet 34—3 previous classical sections— nephritis—lobar pneumonia
K. Kuider	New York Lying-In	1930 to 1932	46 20=2nd 14=3rd 1=4th (low) 1=5th (classi- cal)	1 following classical section	2.0		1 Aet 40—severe diabetic—1 previous classi- cal—severe p.p. hemorrhage—packed from below—died 3 hr. p.o.—no transfusions
J. L. Mont- gomery	Jefferson Medical College Philadelphia Hospital	1925 to 1936	46 35 classicals	2	4.3	229	1 sepsis 2 chronic nephritis and pneumonia
W. B. Thompson	Los Angeles Survey	1923 to 1929	197 (100 sterilized) 180=2nd 15=3rd 2=4th 1=5th	8	4.0	1,225 305 sterili- zations total % deaths 4.2	1 ruptured scar at 7 mo.—hemorrhage and shock 2 ruptured scar after 2½ hr. of labor—hem- orrhage and shock—preventable 3 + 4 operative shock 5 intestinal obstruction—reoperated 2nd day 6 pulmonary embolus 11th day 7 toxemia and previous separated placenta— died of p.p. eclampsia 8 hysterectomy—hemorrhage from uterine artery—preventable

J. A. Smith	Boston Lying-in	1894 to 1932	643 (on 446 patients) 446=2nd 197=3rd or more	22	3.4	1,556 total % deaths 4.9	7 due to sepsis 7 shock and hemorrhage 4 lobar pneumonia 1 intestinal obstruction 2 bronchial pneumonia 1 pulmonary edema and cardiac dilatation
A. J. Skeel and E. F. Jordan	Four Cleveland Hospitals	'94-'14 '14-'22 '22-'32 1927 to 1931	84 262 297 194	2 10 10 8	4.0+	322 (not in labor over 12 hr.) total % deaths 1.86	3 cases of ruptured uterus 4 cases of intestinal obstruction related to dense adhesions 1 p.p. hemorrhage at 4th section 1 of myo- metrial syphilitic changes N.B. 406 classicals 106 low cervicals generally after labor
J. R. Fraser and D. Sparling	Montreal Royal Victoria	1927 to 1936	124	4	3.2 216 elective primary with 1.3% mortality	562 total % deaths 3	
I. Daichman and W. Pomerance	Jewish Hospital Brooklyn	1908 to 1932	180	4 (none in 72 up to 1914)	2.2	733 (151 elective primary with 1 death) total % deaths 3.4	1 1920—2nd section—membranes ruptured 6 hr.—classical—died of peritonitis on 6th day 2 1921—3rd section—classical plus steriliza- tion—died 3rd day of peritonitis 3 1928—2nd section—membranes ruptured 4½ hr.—labor 2½ hr. classical plus steril- ization—died 4th day—embolus 4 1930—2nd section—elective classical plus sterilization—died of sepsis on 7th day
E. M. Hawks	Nursery and Child's New York City	1910 to 1920	114 (only 11 previ- ous to 1920= no deaths)	4	3.4	582 (492 classi- cal)	1 1923—2nd section—died 3 hr. p.o.—hemor- rhage and shock 2 1927—2nd section plus salpingo-oophor- ectomy—died of hemorrhage from injury to vein. 3 1927—2nd section—died of tbc. meningitis —probable contamination from spinal needle 4 1927—2nd section—died of pneumonia
J. P. Hennessey	St. Anne's New York City	1928 to 1941	90	2	2.1	316 (287 classi- cal) total % deaths 2.53	1 Aet 30—gravida iv—3rd section 5 hr. labor—5 cm. rupture of scar—repaired— died of peritonitis on 5th day 2 Aet 33—gravida iii—2nd section—died of peritonitis—(one other ruptured uterus recovered)
Totals			2352	74 (66 with data)	3.15		Sepsis responsible for 30% Hemorrhage and/or shock = 24% Pneumonia = 15% Ruptured uterus = 10% Intestinal obstruction = 9-12% Cardiacs = 5% Anesthesia = 3%

come operative which increase the risk as compared with primary sections. (1) The patients are older. They have passed their prime from the surgical standpoint. Hennessey,¹⁹ Barrett,⁹ and Orengo⁶ believe that from thirty years of age onwards the mortality increases proportionally and is most elevated when the patient is forty years of age or more. (2) Dieckmann and Daily²⁰ have shown that multiparity is one of the factors predisposing to blood loss, due, they believe, to fibrosis or other changes in the uterine wall. This tendency plus ether anesthesia, may explain the frequency of hemorrhages in repeat operation.

The writer has not had difficulty with hemorrhage at primary sections but on five occasions has felt it wise to remove the uterus because of atony either with or without extension of transverse incisions. It is also his impression that excessive hemorrhage at repeat section is more common in hypertensives, nephritics, and cardiacs, a group not uncommon in section statistics. And (3) repeat section on patients in this last group becomes increasingly more dangerous because frequently the natural history of their diseases is such that they become poorer risks as they grow older. It may be safely assumed that the mortality of repeat classical section today can be definitely reduced from 3.2 per cent reported in Table I. Truly elective section with no labor, with the avoidance of inhalation anesthetics and performed in hospitals with well-stocked blood banks should show a reduction in mortality to one-half this or possibly more. Rupture of the scar is variously said to occur in about 4 per cent of cases. A mortality of 11 per cent, which is the average figure reported, would entail an unavoidable 0.5 per cent risk in repeat classical section from this source alone. The dangers of adhesions and hernia also cannot be avoided. Their exact contribution to the risk in terms of percentage is unknown. Were it only one-half that of rupture, these two sources alone—rupture of the uterus and adhesions or incisional hernias would give an unavoidable 0.75 per cent mortality, and this in cases for the most part being operated upon merely for the second time. If we were dealing with truly repeat sections composed of many third and fourth sections, these factors would no doubt ensure an inescapable mortality nearer 1 per cent. Where the improvement in mortality will occur is in the avoidance of sepsis, hemorrhage and/or shock, and pulmonary complications. Today, if the patient is operated upon by competent hands and in the properly equipped hospital, these dangers in a second classical section should not give rise to more than 0.75 per cent mortality. There are logical reasons, therefore, to believe that today the mortality of repeat classical section can be halved from 3.2 per cent of published experience to about 1.5 per cent. This is still a high price to pay for the privilege of having a baby, and the common belief of the past that repeat classical sections are dangerous seems justified by published experiences. The remedy proposed and commonly practiced in this country has been sterilization by various forms of tubal procedures. Whether these tubal resections best solve the problem will soon be discussed.

Table II reveals a far different picture. The chief new factor introduced is the low section. All of Greenhill's²¹ were low sections. Approximately 75 per cent of the cases from the Boston City Series²² were low. About two-thirds of Barrett's⁹ were low, and, of 191 repeat sections of type unspecified, only one of five deaths occurred in a low section, and this was not elective. Of the total 972 repeat sections, 773 were second sections. Only 134 were third cesareans. In addition (chiefly from the Boston City Hospital) 31 had four sections and 10 had more than four. Sterilization was generally practiced at the second operation, and nearly always at the third (except in the Boston City Series). The mortality of the repeat cesareans was 13 deaths, or 1.3 per

TABLE II. CHIEFLY LOW SECTIONS

NAME	HOSPITAL	YEAR	TOTAL REPEATS	NUMBER OF DEATHS	PERCENT DEATHS	TOTAL NUMBER OF SECTIONS	DETAILS OF FATAL CASES
C. J. Duncan and J. B. Doyle	Boston City	1926 to 1936	308 193=second 76=third 26=fourth 10=fifth 2=sixth 1=ninth	3	1.0	703 (550 were low cervical) total percent deaths 4.3	1 no labor—peritonitis 2 no labor—bronchial pneumonia 3 four-hour labor—membranes intact—pulmonary embolus 15 minutes post operatively Types of section not recorded
J. P. Greenhill	Chicago Lying-in	1915 to 1930	127 106=second 9=third 1=fourth	2	1.6	874 (all low) total percent deaths 1.26	1 gravida iv—three previous low sections— anemia of pregnancy—low cervical plus sterilization—died 8th day of peritonitis 2 Aet 34—gravida ii—second low section: obese—membranes ruptured 48 hr.—pre- operative temperature 100° F.—died of peritonitis on 5th day—preventable
E. M. Lazard	Personal in Los Angeles Hospitals	1903 to 1938	108 104=second 4=third	1	1.0	507 (355 low cer- vical) total percent deaths 1.57	1 respiratory paralysis following spinal an- esthesia—dose not stated
T. H. Kelly	Personal cases of R. K. Smith in Los Angeles	1907 to 1936	228 207=second 19=third 2=fourth	2 (218 steril- izations with 2 deaths)	0.9 0.9	894 (559 low cer- vicals) total percent deaths (15 deaths) 1.7	1 pneumonia 2 ? embolus—?—collapse of lungs—no other data
R. L. Barrett	Woman's Hospital in State of New York	1923 to 1938	191 163=second 26=third 2=fourth	5	2.62 1.84 1.69 ---	912 620—low 235—classical total percent deaths 2.96	No data except four deaths after classicals and one after a low cervical—one had labor for 24 hr. with ruptured membranes and anemia—transfused ? type of opera- tion—probably low
Totals			951 773=2 sections 134=3 sections 31=4 sections 10=5 sections 2=6 sections 1=9 sections	13	1.37		

cent. But if Barrett's series is excluded (because four of the deaths were in classical cases) there are 781 cases with eight deaths, or slightly over 1 per cent.

It is well known now that rupture of the uterus and adhesions are much less common after the low section than the classical operation. Just how common rupture after the low section is, is hard to say. Dieckmann¹¹ recently reported 7 in 1,800 cases, a frequency of 0.4 per cent. This is the frequency at the *second* section with a small number of third sections. The vertical incision was used. The figure would be higher if a large number of third or fourth sections were reported. Adhesions of the intestines to the uterus are uncommon after low section. On two occasions, however, the writer has found adhesions of the bladder and lower part of the uterus to the lower part of the abdominal wall so that a classical incision seemed advisable. If this happens, the patient, in the future, assumes the risk of classical repeat section. It seems safe to state, from the results of Table II, that the risk of a second or third low section is about 1 per cent. It also seems safe to assume, because of the factors already mentioned which operate in older patients, and because the risk of rupture will increase with each incision, that this mortality of slightly over 1 per cent at the second and third low section will rise somewhat with each repeat operation. How great the cumulative risk is we do not know. Even 1 per cent is not inconsiderable. It has been said that for the unfortunate who is this 1 per cent, the mortality is 100 per cent. No doubt the mortality will be reduced in good obstetric practice below 1 per cent for the second or third section. Dieckmann¹¹ believes that the low elective operation, "can be performed with a maximum mortality of 0.2 per cent. . . . Other indications are usually accompanied by an increased mortality but the increase should be due to the complication not to the operation." But these complications are not infrequently present and are often *inevitable* in the repeat section. At the present time there is no good reason to believe that large numbers of third, fourth, or fifth sections will show a mortality below 1 per cent. On the contrary, there are reasons to believe that it will be greater.

Table III summarizes the experience at St. Elizabeth's and the Cambridge Hospitals. Three hundred sixteen repeat sections were performed on 213 patients. The mortality was three patients (1 per cent). Where the type of section could be ascertained (some of the previous sections had been performed elsewhere), 75 were classical and 131 low. Although there was a total of 316 repeats, 143 (almost half) had only one repeat operation; 65 had two repeat sections; only 26 had three repeat operations; nine had four; and one had five repeat sections. Therefore, the factor of repetition is not marked in many patients. However, some impressions were obtained from the study. In 57 patients (15 per cent) adhesions complicated the performance of the operation and not by any means following the classical alone, although more commonly after the latter. Incisional hernias had to be repaired in four patients. Very thin uterine scars were found in six patients, and in two additional women there were small ruptures present at the elective operations. In eleven cases there was atony of the uterus with hemorrhage. One required hysterectomy. Seven had "considerable bleeding." It is not clear whether these were simple atony or hemorrhage from uterine incisions or a combination of both. One died of postpartum hemorrhage. One patient had severe sepsis and was fortunate to recover. Three had phlebitis. At the Cambridge Hospital seven sterilizations were performed at the second section, four at the third cesarean, and three at the fourth operation. This series then reveals adhesions, thin scars, atony, and hemorrhage, and incisional hernias as complicating factors as do other cesarean series. They would probably have been more common had a larger number of third, fourth, and fifth sections been

TABLE III

HOSPITAL	YEAR	TOTAL REPEATS	NUMBER OF DEATHS	TYPE SECTION	COMPLICATIONS	DEATHS
Cambridge and St. Elizabeth's Boston	1935 to 1945	316	3	207 known	Adhesions in 57	1 repeat low transverse cervical section—ether anesthesia—died of postoperative hemorrhage 20 hr. post partum
		109	0	131 low cervical	Very thin scars = 6	
		St. Elizabeth's 207	St. Elizabeth's 3=1.5%	76 classical	Incisional hernias = 4	2 repeat low section—GOE anesthesia—severe pyelonephritis—died 6 days post operative—autopsy—peritonitis—multiple small abscesses of kidneys
		143=second	Total 3=1.0%		Rupture of scar = 2	3 one previous section—low under spinal (9 mg. pontocain)—respiratory failure on table—died 48 hr. later—never regained consciousness—autopsy—focal necrosis of thalamus from anoxemia
		65=third			Sepsis = 4	
		26=fourth			Bleeding or atony = 11	
		9=fifth				
		1=sixth				

done. None of the deaths were directly attributable to the fact that the operation was a repeat one.

The remedy proposed for the risk of repeat sections consists in various forms of tubal resection. These procedures effectively remove the danger of future repeat cesareans. The ideal remedy, however, should accomplish not only this but also (1) be simple of performance, (2) have the lowest immediate morbidity and mortality, and (3) lessen future risks from the possible development of pathology in an organ which, from the functional standpoint, has become useless. The various tubal procedures are rather simple to perform, although occasionally the control of oozing is said to be troublesome. Some require more operating time and anesthesia than section alone. As far as morbidity and mortality are concerned, certainly they do not decrease the mortality or morbidity of the conservative operation. The mortality will be at least that of the cesarean, classical, or low as the case may be. Lazard,²³ who has given a good deal of attention to this subject, believes that tubal sterilization adds to the risk because of the dangers of adhesions or the lighting up of infection. Dieckmann¹¹ advises cesarean hysterectomy in patients over 35 years of age. In answer to the question²⁴: "Do you feel that cesarean hysterectomy is immediately a safer operation at the third section than any of the conservative types?" he replied: "We feel that cesarean hysterectomy is the safest operation." Watson²⁵ also favors cesarean hysterectomy over the conservative section plus tubal sterilization. In general, however, tubal procedures are favored and in fact seemingly considered innocuous.

There is a pardonable enthusiasm on the part of some men and clinics for a procedure which has originated with the particular hospital or surgeon. Enthusiasm may, however, dull the critical faculty. It is very difficult, if not impossible, to ascertain whether or not the addition of tubal resection to the conservative operation adds to the risk of the latter. Bishop²⁶ did not even mention mortality, and several years earlier with Nehms²⁷ in another discussion of the operative methods of sterilization stated: "This brief paper . . . is purely one of technique." One hundred cases of sterilization were reported. How many were accompanied by cesarean section is not stated. No mention is made of mortality in their own series although the statement is made: "In 1926 thirty-nine cases had been added to Madlener's first series making in all, excluding four deaths, 124 with no failure." The failure to mention mortality

in reports of the efficacy of operative techniques suggests a preoccupation with the particular techniques so marked as to exclude a broader viewpoint of the patient's safety. Fox,²⁸ reporting on 645 sterilizations at the Boston Lying-in Hospital from 1916 to 1937, failed to mention the mortality in those associated with cesarean section of which there were 152. But Smith,¹⁴ from the same hospital, reported 559 repeat sections from 1914 to 1932 with a mortality of twenty, or 3.2 per cent. A conservation section plus tubal sterilization is not a "success" if the patient dies. Irving²⁹ (Boston Lying-in Hospital), has stated: "Should the mother die it is a tragedy." An analysis of these reports from Lull,^{30, 31} Barrett,⁹ and Adair and Brown³² reveal about the same mortality as Table II and, in fact, Table II is composed mostly of cesareans plus sterilization (with the exception of the Boston City Series).

The answer then as to whether cesarean section plus tubal sterilization has a very low morbidity and mortality is in the negative, for a 1 per cent to 1.2 per cent mortality for an elective procedure is a high mortality today compared with other types of lower abdominal laparotomy. Does tubal sterilization avoid pathologic developments in the uterus? Obviously not. For the sake of the dubious advantage of menstruation, an organ robbed of its reason for existence is allowed to remain as a possible prey to pathologic changes. This bespeaks a short-sighted surgical vision dimmed by a false sentimentalism. Loomis³³ remarked: "If the fundus is removed (at repeat section) there is something in knowing that the excessive flowing of the abnormal menopause, the possibilities of fibroids and adenocarcinoma of the fundus, and the nuisance of comparatively useless menstrual periods are all forever gone." Lazard²³ and Watson²⁵ have expressed themselves in a similar fashion.

The procedure which will most surely lessen the immediate and remote dangers of the repeated section is cesarean hysterectomy. It fulfills the requirements. (1) It is simple of performance according to Williams,³⁴ Shears,³⁵ Lazard,²³ Schumann,¹³ Stander,³⁶ Newell,³⁷ Harris,³⁸ and Phaneuf,³⁹ all possessed of familiarity with the operative technique. A false conception of the difficulties and dangers of the operation exists because of its infrequent performance. If familiarity breeds contempt, unfamiliarity sometimes engenders an unwarranted awe. (2) Is the morbidity and mortality low? There are no reports of very large numbers of elective section, but Lazard²³ and Greenhill²¹ have reported no mortality in their experience, and morbidity reports from series of cases performed on poor risks (infection and the like) are striking in one respect. All emphasize in almost identical phrases the statement of DeLee and Greenhill⁴⁰: "Recovery is more prompt, less painful, and less complicated than after the ordinary cesarean operation." Harris,³⁸ Phaneuf,³⁹ Watson,²⁵ Lash and Cummings,⁴¹ and the Potters⁴² share this viewpoint. Williams,³⁴ the leader of his day, stated flatly that "supravaginal amputation is safer and can be done more rapidly than the conservative operation followed by excision of the tubes." In 1928 he stated: "Early in my career, I recognized that convalescence following cesarean section terminated by supravaginal hysterectomy is much more satisfactory than after the apparently simple conservation (classical) operation." And, recently the Potters⁴² expressed themselves similarly. So far all writers have given preference to supracervical hysterectomy over complete. In view of recent gynecologic experiences with the latter, and its advantages in eliminating future cervical cancer, this viewpoint may have to be re-examined. All stress the remarkable simplicity of the convalescence. The writer has analyzed 32 cases from the Cambridge Hospital and St. Elizabeth's Hospital. Seven were personal cases with assistance at two others. The same easy convalescence was noticed as described by other men. Notwithstanding the usual bad features (infection, ablatio, hemor-

rhage, atony, etc.), 16 of the patients had no morbidity by the strictest of standards. Elective cesarean hysterectomy is safer than repeat elective conservative section of any type for several reasons. (1) It is a complete protection against the danger of operative and postoperative hemorrhage from the uterus. This danger is a very real one in repeat section. It was the greatest cause of mortality in Smith's series.¹⁴ Some of the reasons for this have already been mentioned. Postpartum hemorrhage is not uncommon after cesarean section and yet as Slemmons⁴³ remarked: "Textbooks are silent and monographs on cesarean section and postpartum hemorrhage alike omit discussion of the subject." Marshall⁴⁴ stated: "Some degree of uterine atony is not always avoidable . . . deaths are unfortunately still recorded either from blood loss alone or the superadded shock of hysterectomy." I hardly need add these hysterectomies are not elective but are delayed and are performed in the presence of shock. (2) Cesarean hysterectomy greatly reduces the risk from sepsis and peritonitis. The introduction of the sulfonamides and penicillin in the conservative operations will in the future greatly lessen these dangers although sepsis will still be a factor. Dieckmann¹¹ stated: "No drug has been found to be effective in the cure of anaerobic streptococcic infection." Cesarean hysterectomy will have the benefit of these drugs also and with their use serious infection in elective cesarean hysterectomy should be a rarity. (3) Montgomery⁴⁵ has stated: "Morbidity is the mother of mortality." The relationship is indivisible, and in a large enough series the operation with the lower morbidity will always show the lesser mortality. To the writer it is highly significant that those who have had experience with cesarean hysterectomy have noted time and time again that the convalescence is smoother and the morbidity less than after the conservative operation. DeLee and Greenhill⁴⁰ have attributed this to the absence of the puerperal necrosing uterus. The absence of distention, and pulse and temperature elevation is of great advantage and always of some importance. Their absence is of particular importance in patients suffering from a moderately advanced nephritis, cardiac disease, etc. Slemmons⁴³ studies led him to conclude that there is much less excretory load on the kidneys due to the absence of a puerperal uterus and that this is a factor of practical importance in severe nephritides. Lash and Cummings⁴¹ stated that the operation is particularly indicated in pulmonary tuberculosis because the absence of the uterus means absence of the catamenia, and this has a favorable effect on the course of pulmonary tuberculosis. In comparison with the conservative operation plus sterilization Lazard,²³ Watson,²⁵ and Williams³⁴ stated that the danger of infection is less. Lazard,²³ with a considerable experience, stated: "The Porro procedure can be done in less time and with less shock than a tubal procedure." A few deaths from hemorrhage after conservative section have been reported in Tables I, II, and III. A hemorrhage occurred during the performance of sterilization by tubal procedure. In general, hemorrhage is an important factor in conservative repeat sections. Thompson and Krahulik⁴⁶ stated: "The control of hemorrhage during operation on a healthy uterus would seem to be a minor problem, yet this resulted fatally in four cases." And this was a review of 128 deaths of operations performed by specialists. There were four others who had hemorrhage after section. In addition, two more cases had shock probably from or with hemorrhage, and two others had shock after a low cervical section, in which hemorrhage may have been a factor. All of these difficulties are eliminated by hysterectomy. The mortality of elective cesarean hysterectomy should be well under 0.5 per cent. It should be no greater than that of any lower abdominal gynecologic procedure, simple in performance, done electively, and on the patients most of whom are in good condition.

This statement cannot be made of any of the conservative operations performed as repeat procedures for the reasons given, and because of the experience recorded. Believing the procedure to be safer and that the difference is probably 1 per cent, the opinion of a Catholic moral theologian was obtained in order not to transgress the religious beliefs and rights of Catholic patients. Ford⁴⁷ believes that a difference of 1 per cent mortality is a "very important difference, in fact a decisive difference" and stated in part: "The doctor must judge as best he can, that in this particular case the radical procedure is twice as safe." If one looks at the patient as a whole, as an entity in time, as an individual with a responsibility to a family and husband both now and in the future, it would seem logical to take both the present and future risks into consideration. Those who favor tubal procedures for sterilization seem rather unconcerned as to the future of these patients, or at least unaware of possible dangers. They perform a procedure that carries at least the same and probably a greater risk than the conservative operation, and which definitely fails to avoid possibility of danger in the future, when a procedure simple to perform and with a lower mortality is at hand—and a procedure which at the same time will eliminate future dangers. They have failed to see the forest for the trees. They have been too interested in ingenious little techniques and have lost sight of a consideration of the safety of the patient as a whole.

Conclusions

1. A review of the experience of individuals or of individual hospitals reveals that the mortality of repeat classical cesarean sections in the country has been in the past 3.2 per cent. At the present time this risk probably can be reduced to about 1.5 per cent.
2. A review of similar experiences with the low operation reveals a mortality of slightly over 1 per cent. In both procedures, second cesareans bulk large with a much smaller number of third cesareans and practically none beyond this. It is highly probable that the danger would have been greater than 3.2 per cent in classical, and 1.2 per cent in low sections were a larger number of fourth and fifth cesareans recorded.
3. The dangers of elective repeat section are both immediate and remote. The remote dangers of rupture of the uterine scar and intestinal adhesions are very marked after the classical section, and exist to a much less degree after the low section. A conservative type of section with sterilization removes the dangers of rupture of the scar and risk inherent in another future section, but does not diminish the immediate mortality due to the procedure, nor the immediate and remote dangers from adhesions.
4. Evidence is presented that elective cesarean hysterectomy is simple to perform, causes less blood loss, has a smoother convalescence, and shows less morbidity than conservative repeat sections with or without tubal sterilization; and, in addition, eliminates future dangers from a useless organ, the uterus.
5. The procedure should be given much more consideration as an elective procedure at repeat sections, and should often be performed in the patient over 40 years of age; in the presence of poor scars; when the uterus does not contract perfectly; in the presence of marked adhesions; after the third or more classical section; and in patients who are subject to severe grades of

heart disease, kidney disease, or tuberculosis. Further experience may reveal it to be the procedure of choice routinely at or after the third section, even of the low type.

6. If the patient is a Roman Catholic and the surgeon believes that cesarean hysterectomy is, for that particular patient, a safer procedure than any type of conservative section, he may in the opinion of some Catholic moral theologians perform the operation. The uterus need not be pathologic to justify its removal.

The writer expresses his appreciation to Charles L. Sullivan, M.D., Frederick J. Lynch, M.D., Roy Heffernan, M.D., and Christopher Duncan, M.D., for their encouragement and criticisms of this paper. It is hoped with C. Duncan to present our combined results with cesarean hysterectomy at a later date.

References

1. Adair, F. L., and Brown, I.: *AM. J. OBST. & GYNEC.* 37: 472, 1939.
2. Adair, F. L.: *AM. J. OBST. & GYNEC.* 44: 999, 1942.
3. Gordon, C. A., and Rosenthal, A. P.: *AM. J. Surg.* 54: 540 and 582, 1941.
4. Hawks, E. M.: *AM. J. OBST. & GYNEC.* 18: 393, 1929.
5. DeLee, J. B.: *Yearbook of Obstetrics*, p. 211, 1939.
6. F. Orengo, Diaz del Castillo y a Martinez Jiméno: *Rev. clin. españ.* 13: 1-10, 1944.
7. Bride, J. W.: *J. Obst. & Gynaec. Brit. Emp.* 28: 468, 1921.
8. Arnott, P. H.: *West. J. Surg.* 44: 67, 1936.
9. Barrett, R. L.: *AM. J. OBST. & GYNEC.* 37: 434, 1939.
10. Berkeley, Sir Comyns: *Midwifery by Ten Teachers*, ed. 6, Baltimore, 1938, William Wood and Company, p. 627.
11. Dieckmann, W. J., and Daily, E. F.: *AM. J. OBST. & GYNEC.* 30: 221, 1935.
12. Bourne, A. W.: *Caesarean Section. Recent Advances in Obstetrics and Gynecology*, ed. 4, Philadelphia, 1939, Blakiston Co., p. 81.
13. Schumann, E. A.: *AM. J. OBST. & GYNEC.* 25: 439, 1933.
14. Smith, J. A.: *Surg., Gynec. & Obst.* 57: 621, 1933.
15. Fraser, J. R., and Sparling, D.: *Surg., Gynec. & Obst.* 66: 438 and 440, 1938.
16. Matthews, H. B., and Acken, H. S., Jr.: *AM. J. OBST. & GYNEC.* 38: 956, 1939.
17. Daichman, I., and Pomerance, W.: *AM. J. OBST. & GYNEC.* 25: 522, 1933.
18. Wilson, K. M.: *AM. J. OBST. & GYNEC.* 12: 268, 1926.
19. Hennessey, J. P.: *North Carolina M. J.* 3: 217, 1942.
20. Dieckmann, W. J., and Daily, E. F.: *AM. J. OBST. & GYNEC.* 44: 67, 1936.
21. Greenhill, J. P.: *AM. J. OBST. & GYNEC.* 19: 613, 1930.
22. Duncan, C. J., and Doyle, J. B.: *New England J. Med.* 26: 1, 1937.
23. Lazard, E. M.: *West. J. Surg.* 48: 294, 1940; 46: 14, 1938. Also *California & West. Med.*
24. Dieckmann, W. J.: *Personal Communication*; August, 1945.
25. Watson, B. P.: *AM. J. OBST. & GYNEC.* 34: 512, 1937.
26. Bishop, E.: *AM. J. OBST. & GYNEC.* 34: 505, 1937.
27. Bishop, E., and Nehms, W.: *N. Y. State J. Med.* 30: 214, 1930.
28. Fox, F. H.: *Surg., Gynec. & Obst.* 11: 462, 1940.
29. Irving, F.: *Connecticut M. J.* 1: 483, 1936-1937.
30. Lull, C. B.: *AM. J. OBST. & GYNEC.* 31: 101, 1936.
31. Lull, C. B.: *Pennsylvania M. J.* 43: 956, 1939-40.
32. Adair, F. L., and Brown, I.: *AM. J. OBST. & GYNEC.* 37: 472, 1939.
33. Loomis, F. M.: *West. J. Surg.* 46: 47, 1938.
34. Williams, J. W.: *Obstetrics*, ed. 6, Philadelphia, 1916, J. B. Lippincott and Co., p. 547 and 549.
35. Shears, G.: *Obstetrics*, Philadelphia, 1916, J. P. Lippincott Co.
36. Stander, H. J.: *Williams' Obstetrics*, ed. 8, New York, 1941, D. Appleton-Century Co., p. 1211.
37. Newell, F.: *Monograph on Cesarean Section*, New York, 1921, Appleton Co., p. 149.
38. Harris, J. W.: *Bull. Johns Hopkins Hosp.* 33: 318, 1922.
39. Phaneuf, L. E.: *Am. J. Surg.* 13: 65, 1931.

40. DeLee, J. B., and Greenhill, J. P.: Principles and Practice of Obstetrics, ed. 8, Philadelphia, 1943, W. B. Saunders Company, p. 1031 and 1022. Also ed. 7, 1938, p. 1136.
41. Lash, W. B., and Cummings, W. S.: AM. J. OBST. & GYNEC. 30: 199, 1935.
42. Potter, I. W., and Potter, M. S.: Am. J. Surg. 32: 33, 1941.
43. Slemons, J. M.: AM. J. OBST. & GYNEC. 26: 661, 1933.
44. Marshall, C. M.: Cesarean Section, Baltimore, 1939, Williams and Wilkins Co., pp. 136 and 137.
45. Montgomery, T. L.: AM. J. OBST. & GYNEC. 31: 968, 1936.
46. Thompson, W. B., and Krahulik, E. J.: West. J. Surg. 46: 31, 1938.
47. Ford, J. C.: Current Theology, a reprint from Theological Studies, Vol 5, December, 1944. (Reference to articles in tables not included in the text.)
48. Mohler, R. W.: AM. J. OBST. & GYNEC. 25: 456, 1943.
49. Kuider, K.: Pregnancy Following Cesarean Section, Surg., Gynec. & Obst. 62: 887, 1936.
50. Skeel, A. J., and Jordan, E. F.: AM. J. OBST. & GYNEC. 23: 172, 1932.
51. Thompson, W. B.: AM. J. OBST. & GYNEC. 19: 392, 1930.

FETAL MORTALITY IN CESAREAN SECTION*

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IN 1939 Matthews and I reported a critical survey of the cesarean sections performed at the Methodist Hospital in Brooklyn from Jan. 1, 1920, to Jan. 1, 1938. It was noted with some concern that there was, in that series, a fetal mortality rate of 5.2 per cent. Such a fetal loss seemed high for an operation which has been associated with the idea, either expressed or implied, of fetal salvage. In comparing our fetal loss with that of others reported up to that time, however, it was found that ours was not unusually high. Within this past year it was decided to reascertain the fetal loss rate for a more recent period of time, to compare the findings with other recent reports, and to study the factors responsible for the loss. This present survey is an analysis of the fetal deaths in cesarean section at the Methodist Hospital for the ten-year period from Jan. 1, 1936, to Jan. 1, 1946.

In Table I are presented the general figures for this series and a comparison with the previously reported series. All infants of 28 weeks' gestation or over and all neonatal deaths up to the fifteenth day postpartum are included

TABLE I. MATERNAL AND FETAL MORTALITY IN CESAREAN SECTIONS
(METHODIST HOSPITAL)

	NO. CASES	MATERNAL MORTALITY		FETAL MORTALITY	
		NO.	PER CENT	NO.	PER CENT
1920-1938	1,066	34	3.18	56	5.2
1936-1946	768	5	0.65	38	4.9

in the report. It will be noted that there has been a striking improvement in maternal mortality in the past ten years but that the fetal loss rate has remained almost unchanged. The improvement in maternal loss reflects, of course, the great stress placed on this phase of the subject. But there has been no such emphasis on the fetal loss associated with cesarean section. Most reports of the operation do little more than casually mention, and dismiss, the condition of the infant and some do not include it at all. It is hoped that emphasis on fetal mortality may help to reduce this loss.

A comparison of the fetal mortality rates in hospitals from different sections of the country is given in Table II. These figures are from recently reported series. It is interesting to note that there is no constant relationship between maternal and fetal mortality statistics. This fact was even more noteworthy in Table I, where the same hospital reported the two series, and where the marked reduction in maternal mortality was not accompanied by an improvement in fetal loss. It seems quite probable, therefore, that the same factors are not involved in the two mortality rates. In fact, in some instances, such as placenta previa, the factors appear to be antagonistic to each other.

*Presented at a meeting of the New York Obstetrical Society, Dec. 10, 1946.

TABLE II. COMPARATIVE STATISTICS OF FETAL MORTALITY IN CESAREAN SECTION

YEARS REPORTED	NO. CASES	FETAL MORTALITY RATE	MATERNAL MORTALITY RATE	SOURCE OF REPORT
1920-1943	1,088	16.14%	5.07%	University of Maryland
1938-1942	500	9.2%	0.40%	Chicago Lying-in
1896-1942	1,333	6.0%	2.80%	Johns Hopkins
1926-1942	233	6.0%	2.10%	University of Iowa
1922-1944	362	4.4%	2.20%	Baylor Medical College
1935-1945	633	No Report	0.31%	New Haven Hospital
1936-1946	768	4.9%	0.65%	Methodist Hospital

TABLE III. CAUSES OF FETAL DEATH

	NO. CASES	NO. AUTOPSIES
Congenital anomalies	5	4
Prematurity	18	10
Macerated	4	2
Congenital atelectasis	3	2
Bronchopneumonia	2	2
Undetermined	2	0
"General congestion" (stillbirth)	1	1
Erythroblastosis fetalis	1	1
Hemorrhage of the newborn	1	1
Gastroenteritis	1	0
Total	38	23 (60.5%)

The maternal risk in cesarean section should not be increased even to minimize the fetal risk.

The actual causes of death of the infants in this series are listed in Table III. Twenty-three of the thirty-eight infants were autopsied and one congenital anomaly was so marked that it was an evident cause of death. This was a case of extrophy of the bladder, imperforate anus, and agenitalia. In three of the cases of congenital malformation the condition was discovered, or fully confirmed, only at autopsy and it may be that other anomalies were not discovered because of a lack of this examination. On the other hand, autopsy in the newborn is not always a conclusive examination, for some of the autopsies failed to disclose a perfectly satisfactory cause of death. The five congenital anomalies were all of such type as to be true causes of death. There was one other congenital deformity, a hare lip, but this was an incidental finding in a premature and was not of sufficient severity to be classed as even a contributory cause of death. The hare lip was the only abnormality found in the placenta previa group. Of the five congenital anomalies causing death of the infant, only one was of bony structure which might have been identified by preoperative x-ray examination.

Under the heading of prematurity in Table III are included only those infants whose deaths were considered to be due solely to prematurity or to prematurity and atelectasis. It does not include all the premature infants of the series. The babies varied in weight from 1,220 to 2,500 Gm., and all deaths occurred in the neonatal period, only one living more than twenty-four hours. The diagnosis was established at autopsy in 10 of the 18 cases. This percentage is low, and should be increased if we are to have completely accurate findings. The fact that an infant is premature is no contraindication to autopsy. Eleven of the eighteen deaths due to prematurity occurred after operation for placenta previa. Twelve of the babies in this group were delivered under regional anesthesia.

The care of the premature infant at the Methodist Hospital is given by qualified pediatricians. This is true for both ward and private cases, for it is felt that premature infants require this specialized care.

The four macerated infants exhibited no further cause of death. They comprise the bulk of the stillbirths. One of these four was clearly an instance of error in diagnosis. The cesarean section was done ostensibly for fetal distress but it is quite evident that any active distress had ceased before operation. The baby was extremely large, weighing 4,660 Gm., and the mother was a primigravida. The other three macerated stillbirths present a controversial point. All occurred in patients who had previous cesareans. We have followed the dictum of "once a cesarean, always a cesarean." This is done primarily as a maternal indication, and hence was followed in these cases despite the previous knowledge of a dead fetus in each instance. All of the babies weighed over 2,700 Gm. In two instances there was considerable justification for repeating cesarean section. One patient had had three previous classical cesareans with no vaginal deliveries. The other had had two previous classical cesareans and a myomectomy with no vaginal deliveries. In the third case the patient had had but one previous cesarean, a low flap type for placenta previa. This case might have been delivered vaginally of the fetus which was known to be dead.

The three cases listed as congenital atelectasis were all full-term infants. It is recognized that atelectasis, or insufficient expansion of the lungs, is a mere descriptive term and not a primary cause of death, but, in the two cases subjected to autopsy, no further findings were noted to explain the atelectasis. Both babies were delivered under spinal anesthesia. The third case was not autopsied, but review of the chart shows that the mother was operated upon because of previous cesarean section and had a prolonged ether anesthesia prior to the birth of the baby. This was probably the cause of the atelectasis.

The two babies who died of bronchopneumonia were delivered under spinal anesthesia. One was a premature infant weighing 1,362 Gm., and the other was a full-term infant weighing 3,632 Gm. Neither lived over twenty-four hours. The larger of these was the child of the elderly primipara whose operation was done largely to avoid fetal risk.

The two cases in which the cause of death was undetermined were full-term infants delivered under spinal anesthesia. One was a stillbirth, the fetal heart of which was heard definitely before operation, and the other was a neonatal death. This latter was suspected of having a diaphragmatic hernia, but the recorded evidence is inconclusive, and no autopsy was performed.

The death listed as "general congestion" was a stillbirth, the indication for operation being face presentation. The mother labored for twelve hours before operation was performed. This infant had a marked congestion of all the organs including the brain, and it is possible that this baby died as a result of the labor. Operation was done under local anesthesia.

The case of erythroblastosis fetalis occurred in a patient operated upon because of placenta previa. The baby was premature and lived only a few hours. The hemorrhage of the newborn occurred in a case of ablatio placenta. It also was premature and lived but a few moments. The case of gastroenteritis was a full term infant. This death has no obstetric significance but it should remind us that the type of delivery is no guarantee against future infections.

In Table IV are listed the indications for cesarean section in relation to fetal mortality. Because we have no control over congenital anomalies, a separate column was added excluding these cases. The fetal mortality in the placenta previa group is high, and it is largely a mortality of premature in-

TABLE IV. INDICATIONS FOR CESAREAN SECTION IN CASES OF FETAL MORTALITY

	TOTAL CASES FOR INDICATION	FETAL MORTALITY		FETAL MORTALITY (LESS CON- GENITAL)	
		NO.	PER CENT	NO.	PER CENT
Placenta previa	56	14	25.0	14	25.0
Previous cesarean	272	9	3.3	7	2.5
Toxemias (no eclampsia)	31	5	16.1	4	12.9
Ablatio placenta	9	3	33.3	3	33.3
Contracted pelvis	259	3	1.1	2	0.7
Fetal distress	3	1	33.3	1	33.3
Previous vaginal plastics	11	1	9.0	0	0.0
Abnormal presentations (face, brow, transverse)	14	1	7.1	1	7.1
Elderly primipara	13	1	7.1	1	7.1

fants. Twelve of these fourteen deaths occurred in prematures and eleven of the deaths are ascribed to prematurity alone. Of these twelve deaths in prematures, eight of the cases were delivered under regional anesthesia and four under general.

The group of patients subjected to repeat cesarean showed a rather high fetal mortality. This included, however, two congenital anomalies and the three macerated stillbirths which have already been discussed. Of the remaining four deaths, three were due to atelectasis and one to gastroenteritis. All of these were neonatal deaths. The infants all weighed over 2,900 Gm. and were of thirty-eight weeks gestation or over. Prematurity was not a factor in this group of deaths.

All the patients subjected to cesarean section for toxemia were classified as pre-eclampsics. None had progressed to the stage of eclampsia. We employ cesarean section in toxemia only when there is a progressive condition which fails to respond to conservative treatment. The operation is further limited to those patients in whom vaginal delivery is not feasible, such as a primipara with a long, tight cervix. Patients who have progressed to the stage of convulsions are not considered suitable risks for cesarean section, and the operation is not advocated unless further complication, such as marked pelvic contraction, makes it imperative.

The babies that were lost in the toxemia group were all small, the largest weighing 1,575 Gm. There was one congenital anomaly. All of the deaths occurred in the neonatal period. The marked prematurity and the increasingly severe toxemia of the mother combined to make a decidedly unfavorable prognosis for these infants.

As would be expected, the infant loss rate is extremely high in ablatio placenta. It has been our policy to treat most of these patients conservatively. There is little encouragement in the fetal mortality statistics for the use of cesarean section, and vaginal delivery has given satisfactory maternal results.

There should be little fetal mortality among the patients operated upon for contracted pelvis unless operation is delayed unduly. In this series there were three deaths in the contracted pelvis group. One of these was due to a congenital anomaly. In another the cause of death was undetermined though it was suspected that the baby had a diaphragmatic hernia. The evidence was not conclusive, however, and autopsy was not performed. In the third case death was due to prematurity. The baby weighed 2,240 Gm. and was delivered under spinal anesthesia. Cesarean section was performed after three hours of labor with ruptured membranes. The mother had had two previous stillbirths in vaginal delivery. Her pelvis was an asymmetrical one with a tilt to the left

as a result of an ankylosing lesion of the left hip following infection in childhood. The configuration was noted clinically and confirmed by x-ray.

Fetal distress as an indication for cesarean section occurred three times in the 768 operations. In each instance the patient was a primigravida who was operated upon early in labor for an abnormality in the fetal heart rate of such character as to indicate distress. It should be pointed out that great care must be exercised in these instances. In the macerated stillbirth occurring in this series, the maternal pulse was evidently mistaken for the fetal heart. There could have been no real fetal distress just prior to operation.

It is difficult to see any connection between indication for operation and fetal mortality in those patients operated upon because of previous vaginal plastics. These cesarean sections were all elective operations and were performed because of previous vaginal operations for repair of the perineum, anterior, and posterior walls and cervixes. Three of these patients had bad rectovaginal fistulas repaired prior to the cesarean section. The one fetal death in this group was due to a congenital anomaly.

The abnormal presentations, face, brow, and transverse, were treated by cesarean section fourteen times in this series. There was but one fetal loss, a face presentation subjected to twelve hours of labor and delivered under local anesthesia. The baby was a stillbirth weighing 3,175 Gm. Earlier intervention in this case might have given a more favorable result. The autopsy diagnosis was "general congestion."

Of the patients operated upon for the indication of elderly primipara, only one showed a fetal loss. This was a neonatal death of a 3622-Gm. infant delivered under spinal anesthesia. The autopsy diagnosis was bronchopneumonia.

In Table V are listed the types of anesthesia used in the cases associated with fetal loss. Regional anesthesia was used in 71 per cent of the cases and in 72 per cent of the prematures. This type of anesthesia avoids the danger of increased anoxia to the fetus.

TABLE V. TYPE OF ANESTHESIA IN CASES OF FETAL MORTALITY

	PREMATURE	FULL TERM	TOTAL
Spinal	13	9	22
Local	3	2	5
General	6	5	11

TABLE VI. VIABLE FETAL MORTALITY (1936-1946)

	TOTAL CASES	FETAL MORTALITY		STILLBIRTHS	NEONATAL DEATHS
		NO.	PER CENT		
Vaginal deliveries	18,016	652	3.6	420	232
Cesarean sections	768	38	4.9	6	32*

*25 lived less than one day; 7 lived more than one day.

Spinal anesthesia affords far better relaxation of the maternal abdominal muscles, and in this respect has a distinct advantage over local anesthesia. This greater relaxation is an aid in the delivery of the fetus and is of particular importance in the case of the premature infant where ease of delivery plays so great a role in avoidance of trauma. It should be noted here also that the incision in the uterus must be of sufficient size to insure easy delivery of the infant. The maternal tissues are also subjected to less trauma where proper muscular relaxation is achieved, and it is our feeling that spinal anesthesia is an extremely valuable aid when given properly and under competent supervision. We now use general anesthesia only in those few cases where spinal is either refused or contraindicated. It should be avoided particularly in the delivery of the premature infant.

A comparison of the viable fetal mortality associated with vaginal and cesarean delivery is given in Table VI. The relatively large number of stillbirths in cesarean section requires some consideration. Four of these were macerated infants. They have been previously discussed in this paper. The other two stillbirths exhibited a fetal heart before delivery and a heartbeat at delivery. Neither could be made to breathe. The cause of death in one of these was undetermined and autopsy was not performed. In the other the autopsy diagnosis was "general congestion." This was the face presentation which was subjected to twelve hours of labor. Both of these infants were delivered under spinal anesthesia. None of the stillbirths was premature, the smallest weighing 2,725 Gm.

Twenty-two of the neonatal deaths occurred in premature infants, and, of those infants expiring in the first twenty-four hours of life, eighteen were premature. This is in accord with other statistics of premature infants showing a high rate of fetal mortality shortly after delivery. The importance of care just prior to delivery and after delivery must be stressed in order to effect a greater saving of these small infants.

We have seen that a large part of the fetal mortality in cesarean section in this series has been the mortality of prematures and particularly prematures associated with placenta previa. The rate of premature mortality in vaginal delivery as contrasted with that in cesarean delivery is shown in Table VII. Cesarean section presents almost twice the premature fetal mortality of vaginal delivery. If the cesareans performed for placenta previa are excluded, however, the cesarean rate approximates that of vaginal delivery. In Table VIII these cases have been broken down into the various weight groups. It will be noted that the different weight groups are fairly proportionately represented in each type of delivery. In certain of these weight groups we are dealing with rather small numbers of cases so that a comparison of individual weight groups does present the possibility of error. However, the over-all picture is extremely suggestive of the fact that cesarean section for placenta previa carries with it an added risk for the premature infant, and that that risk is increased by some factor other than size of the infant alone.

TABLE VII. PREMATURE FETAL MORTALITY

	SURVIVED	DIED	MORTALITY RATE
Vaginal deliveries	500	139	21.7% (217 per 1,000)
Total cesareans	34	22	39.2% (392 per 1,000)
Cesareans less placenta previa	28	10	26.3% (263 per 1,000)
Cesareans performed for placenta previa	6	12	66.6% (666 per 1,000)

TABLE VIII. PREMATURE FETAL MORTALITY

	VAGINAL DELIVERIES			TOTAL CESAREANS			CESAREAN LESS PLACENTA PREVIA			CESAREAN FOR PLACENTA PREVIA		
	SUR-VIVED	DIED	MOR-TAL-ITY RATE	SUR-VIVED	DIED	MOR-TAL-ITY RATE	SUR-VIVED	DIED	MOR-TAL-ITY RATE	SUR-VIVED	DIED	MOR-TAL-ITY RATE
907-1,361 Gm.	15	44	74.5	3	3	50	3	1	25	0	2	100
1,361-1,814 Gm.	63	44	41.1	2	9	81.8	1	4	80	1	5	83.3
1,814-2,268 Gm.	263	35	11.7	11	8	42.1	10	3	23	1	5	83.3
2,268-2,495 Gm.	359	16	4.3	18	2	10	14	2	12.5	4	0	0
Total	500	139	21.7	34	22	39.2	28	10	26.3	6	12	66.6

Maternal hemorrhage is the major factor differentiating a cesarean section for placenta previa from the general run of cesarean sections. It is frequently difficult to estimate the extent of that hemorrhage, for the original bleeding occurs before the patient enters the hospital, and even the bleeding in the hospital presents a problem in accurate estimation except as the patient herself exhibits the effect of it. However, the fact that a patient is transfused is evidence that, in the opinion of the attending obstetrician at least, the bleeding has been excessive. In the cases of placenta previa subjected to cesarean section in this series, the operations were performed as promptly as possible after the hemorrhage. This was particularly true of those that had bled sufficiently to warrant transfusion. In these cases there was, of course, prompt matching of blood and prompt transfusion, but transfusions were started either at the time of operation or after operation. This meant that the replacement of maternal blood came either shortly before the delivery of the child or immediately thereafter. In either case the transfusion would have little effect upon the infant. In his book, *The Physiology of the New Born*, C. A. Smith states that "the respiratory characteristics of fetal and neonatal blood indicate the need for a sufficient if not an augmented supply of oxygen to the infant both during and after birth." Beck, in his paper, "The Obstetrician's Responsibility in Anoxia and Prematurity," states, "Anything which might reduce the oxygen content of the maternal blood—might well lead to anoxia in the fetus." In the conditions described, these premature infants have had a decreased supply of oxygen as a result of the maternal hemorrhage and the replacement has occurred after it is of little value to them even though the mother may be fully cared for by this replacement. Potter and Adair make the statement that "Primary anoxemia is always intrauterine in origin, although its effect may be such that the infant does not succumb until after birth." As confirmation of the effect of maternal blood loss upon the child, it was noted in the present survey that in those cases of cesarean section for placenta previa where maternal transfusion was necessary the fetal mortality was 52.9 per cent. In those cases of cesarean section for placenta previa where no maternal transfusion was given the fetal mortality was 15.4 per cent. There were no transfusion reactions and it should be recalled that the transfusions were given at such time as to have comparatively little effect upon the child, thus indicating that the maternal blood loss was a factor in the fetal mortality.

It is therefore suggested that maternal transfusion be given in all cases of hemorrhage as early as possible and as long prior to operation as is feasible, in order to avoid the increased risk of delivering a premature infant with the additional problem of anoxia induced by maternal blood loss. Pure oxygen should be given the mother so that the risk of anoxia in the infant may be further reduced. This should be started as soon as possible after hemorrhage occurs and continued to the time of birth in any case where appreciable bleeding has occurred. This procedure should not be dependent solely upon the condition of the mother but should be given in the interest of the child.

H. W. Johnson and Macafee have advocated delay in emptying the uterus in placenta previa. There may be some instances in which this is possible but to advocate delay as a general policy in placenta previa would seem to invite disaster. A very wide experience and fine judgment are needed to determine the case that might be delayed. It is granted, however, that such delay would, if successful, enhance the chances of survival of the fetus. The marked improvement in maternal mortality in placenta previa would be greatly endangered by widespread advocacy of this policy of delay.

No attempt is made in this paper to discuss the routine care of the premature infant, for that has been very ably covered by other authors.

Conclusions

1. Fetal mortality in cesarean section is higher than that for vaginal delivery.
2. An increase in autopsies on stillbirths and neonatal deaths is imperative in the interest of accurate diagnosis.
3. If cesarean is indicated in cases of abnormal presentation, operation should be performed early.
4. Regional anesthesia avoids one cause of fetal anoxia and should be widely used in cesarean section. Spinal anesthesia produces greater relaxation thereby aiding delivery and lessening trauma to the baby.
5. Prematurity is the greatest single cause of fetal mortality in cesarean section. It occurs most often in conjunction with placenta previa.
6. The policy of delay in active treatment of placenta previa might carry more infants closer to term, but widespread advocacy of this would endanger the present low maternal mortality.
7. In cases of maternal hemorrhage the mother should have early transfusion and the administration of pure oxygen to combat fetal anoxia. These procedures should be carried out even though there be no apparent need of them by the mother.

34 PROSPECT PARK, WEST

Discussion

DR. WILLIAM E. STUDDIFORD.—Most series of cesarean sections which have come to our attention have been analyzed from the standpoint of maternal mortality, and in most of them the fetal mortality is rather high. In many the outstanding cause of death is prematurity.

While a great deal of this fetal loss is due to factors such as placenta previa and toxemia which necessitate interruption of pregnancy before term, some is due to error in the estimation of the duration of pregnancy. It is often difficult to determine the expected date of confinement, especially in those patients who occasionally skip menstrual periods. The estimated date of confinement is very often false. In cases where the maturity of the baby is in doubt, it is probably wise to await the onset of labor before performing cesarean section.

DR. SAMUEL A. WOLFE.—There is one other point in connection with the treatment of placenta previa by cesarean section. With the delivery of the baby, the placenta may be traumatized with considerable loss of fetal blood from the vessels in the torn chorionic villi. It may be wise in placenta previa with a premature baby not only to give oxygen and maternal transfusion early, but also to give the baby a transfusion if there has been considerable bleeding from the placenta, especially if there has been delay between the time of incision of the uterus and delivery.

DR. CLAUDE E. HEATON.—I think we should be grateful to Dr. Acken for keeping in mind the point that cesarean section does not guarantee a live baby. In 271 cases at the French Hospital there was a loss of 12 babies, or 4.4 per cent.

The subject of anesthesia should be emphasized. Many fetal deaths are not preventable, for example, those due to prematurity in toxic mothers. However, infants of large size are occasionally lost from poor anesthesia. Local or spinal anesthesia is valuable in selected cases.

I am sorry Dr. Studdiford did not go into the expectant treatment of placenta previa. On his service the expectant treatment has been quite successful, often providing the infant with a better chance of survival without extra risk to the mother.

DR. RALPH L. BARRETT.—I'd like to know what is meant by the expectant treatment of placenta previa.

DR. CLAUDE E. HEATON.—In answer to Dr. Barrett, I would like to cite the case of a woman who was about seven months' pregnant, who lost about 500 c.c. of blood. She was hospitalized for six weeks and then sent to a hotel until labor began. It would have been very easy, with the initial considerable loss of blood, to have done a section for placenta previa.

A patient with placenta previa can be safely observed provided she is in a good hospital with a blood bank and a good resident staff. If she can be carried over two or three weeks, you can sometimes guarantee a live baby.

On Dr. Studdiford's service we observe these patients until the baby is big enough, and then examine them in the operating room prepared to do section. I doubt whether we risk any lives that way.

DR. E. EVERETT BUNZEL.—The discussion gives the impression that cesarean section is about the only treatment for placenta previa. There is a great need for individualization of each patient, and there is a large number of patients who can be delivered vaginally who have placenta previa or even accidental hemorrhage, depending on parity and the condition of the cervix. Several years ago, Dr. B. P. Watson discussed this problem and showed that in many instances it was quite possible to deliver vaginally, and that the fetal mortality rate in selected cases was no greater than that associated with abdominal section.

DR. SAMUEL A. COSGROVE.—It is rather unfortunate that Dr. Bunzel should assume that the consensus of opinion in this Society is that every case of placenta previa should be subjected to cesarean section. Dr. Watson's estimation of the treatment of placenta previa would be largely approved by every member of this organization.

I perhaps misunderstood Dr. Bunzel, but if I understood him correctly, I want to dissent very emphatically with him in his assumption that anybody here has put forth the doctrine that placenta previa should invariably be sectioned.

DR. E. EVERETT BUNZEL.—I have no rebuttal to offer Dr. Cosgrove. However, I don't think he got the gist of my remarks. I do not recall anything in the presentation which referred to the vaginal delivery in placenta previa. I got the impression that cesarean section was advocated. There are many cases in which it is not necessary to do a section. There are also many cases erroneously diagnosed as placenta previa.

DR. ACKEN (Closing).—In answer to Dr. Studdiford, there were nine babies lost in the repeat cesarean section group in our series, none of them premature infants. The smallest baby in the group weighed 2,900 Gm. and was of 38 weeks' gestation. There was no loss from prematurity itself.

I think that the widespread advocacy of the expectant treatment of placenta previa as a general measure would do a great deal of harm. No doubt in competent hands it could be carried out safely, but I feel it should not be done as a general measure throughout the country.

I regret creating a wrong impression in the mind of Dr. Bunzel. We deliver many cases of placenta previa per vaginam but the patients under discussion tonight were simply those who had been delivered by cesarean section.

**VAGINAL HYSTERECTOMY WITH RADICAL ADVANCEMENT OF THE
UTEROSACRAL LIGAMENTS FOR PELVIC FLOOR HERNIOPLASTY
IN CASES SHOWING THIRD DEGREE UTERINE PROLAPSE***

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IT IS generally agreed that the numerous operations commonly used for the repair of third degree pelvic herniation, popularly called uterine prolapse, are not completely satisfactory since recurrences of the hernias are common, and unsatisfactory vaginas are a frequent end result. For this reason the authors have developed a technique which reinforces the sites of herniation and leaves an adequate vagina. To accomplish this, the strong fascial tissues of the uterosacral ligaments are fixed between the bladder with its fascial structures and the vaginal wall. They are attached to the arcuate pubic ligament on each side of the urethra in such a manner as to reinforce the pubo-cervical fascia so firmly that a recurrent cystocele, urethrocele, colpocele, or enterocele is rare.

For years the medical profession has been intensely interested in the relief and cure of uterine and vaginal herniations. Life often becomes quite intolerable to a woman when her pelvic organs become markedly prolapsed. This distressing condition usually interferes with urination, defecation, and coitus. Primarily, such a patient is interested in obtaining relief from the associated physical discomforts; when these are alleviated through a surgical approach, she remains disappointed unless restoration of the natural function of the vaginal canal is also attained. Any operation that interferes with normal coital relations is therefore unsatisfactory. With this restoration in mind many methods of repair have been devised, but a large variety of these have been found to produce end results which are not completely satisfactory.

* * *

Most of the operations which have been proposed during the present century for the correction of uterine prolapse have produced high percentages of cures. However, according to current medical literature, the percentage of partial or total failures (as characterized by a recurrent cystocele, urethrocele, colpocele, enterocele, rectocele, or any combination of these hernias) ranges from 4 to 30 per cent where these various operations are used. Furthermore, even though no hernias redevelop, the end results with many of these procedures are unsatisfactory, as they produce vaginas which are very much shortened.

It then becomes obvious that as yet we have no ideal operation for the correction of uterine prolapse. Probably no single plan of reconstructive

*Presented, by invitation, before the Chicago Gynecological Society, May 17, 1946.

†Deceased December, 1944.

surgery will ever be devised which will be applicable to all types of individuals seeking care for prolapse; obviously in cases where it is advisable to conserve the uterus for future pregnancy the treatment will usually vary from that offered a postmenopausal case. The surgeon will in the future, as in the past, undoubtedly have to individualize his patients and rely upon various surgical procedures to obtain the best possible end result for any given case.

Anatomy

The anatomy of the female pelvis has been thoroughly studied during recent years and presented in detail by Curtis and his associates, rendering unnecessary any review of this subject at this time. However, for the purpose of this paper, it should be recalled that all the pelvic ligaments contain smooth muscle as well as connective tissue, and therefore are very prone to hypertrophy under the stress of constant pull such as occurs in prolapse. Because of this, one frequently finds the round ligaments and uterosacral ligaments thicker than normal in such cases—a fact which increases the value of these ligaments in any effective surgical reduction.

A second anatomic fact which bears accentuation at this time concerns the nature of the ligaments which form the upper boundary of the pubic arch. The subpubic ligament, or so-called arcuate pubic ligament, is a thick triangular arch of strong ligamentous fibers which connects the right and left pubic bones, and serves to round off the pubic angle. Below this arcuate pubic ligament lies a second ligament, the transverse ligament of the pelvis, which is composed of the fascias covering the inferior and superior surfaces of the urogenital diaphragm. This so-called transverse ligament of the pelvis extends from one side of the pubic arch to the other, and blends with the pubic arcuate ligament on each side. Both of these ligaments, especially the arcuate, are ideal for anchorage purposes in pelvic repair work.

Operative Repair

A third degree prolapse is commonly defined as a descent of the uterus to the extent that the cervix or corpus uteri protrudes through the vulva. As a result of this the bladder and urethra are often pulled down from the symphysis pubis resulting in a large cystocele and a urethrocele. Likewise, the rectum is usually pulled down and forward producing a rectocele. Because the peritoneum of the posterior cul-de-sac may also be drawn down with the uterus, an enterocele may develop. Most gynecologists agree that a third degree prolapse, occurring in an individual past the age of menopause or in whom it is no longer definitely advisable to conserve the uterus, may best be corrected by removing the uterus together with all grossly diseased tissue, and closing the hernial sacs with a repair of the pelvic floor. Therefore, the uterus is removed, the posterior cul-de-sac greatly diminished in size, the cystocele reduced, and the urethral sphincter tightened if it shows relaxation, and the pelvic floor repaired.

In order to accomplish this, the writers developed the operation described herewith which differs as follows from other techniques advocated for the

same purpose: after performing a vaginal hysterectomy in a routine manner and uniting the broad ligaments in the midline, the cystocele is corrected by incising the vaginal wall over the bladder from below upward, and the pubo-cervical fascia is dissected and sutured in the midline, following which *the uterosacral ligaments, previously dissected from the cervix and posterior fornix, are advanced and firmly attached to the arcuate pubic ligament on each side of the urethra.* Following this work the perineum is repaired as a routine procedure.

Before undertaking this or any other operation, sound surgery requires that a careful examination be made to establish the correct and full diagnosis. In the operation herewith proposed, the existence of large tumors, multiple adhesions, and active inflammations, as well as pregnancy, constitute obvious contraindications to surgery. In very obese and uncooperative patients an examination under anesthesia may be necessary to establish the diagnosis.

In transvaginal surgery, the importance of the preoperative preparation of the field of operation cannot be too strongly emphasized, since one of the authors some years ago observed two cases of fatal peritonitis following negligence in this regard. Our patients submit to the following routine after the onset of anesthesia. The perineal region and the vaginal outlet, together with the vagina and the herniating structures, are thoroughly scrubbed with soap and water and then painted with a standard antiseptic solution of known efficacy. The patient is draped, and then the vagina is swabbed with a 2 per cent iodine solution followed with 70 per cent alcohol.

Technique

Three or more heavy silk sutures are placed through the anterior and posterior lips of the cervix in order to occlude the cervical canal as well as to afford a means of traction. An elliptical incision is made through the vaginal wall circumscribing the cervix just proximal to the bladder reflection, and 2 c.c. of pitocin are injected into the parametrial structures to minimize bleeding. The bladder is now separated from the cervix by blunt dissection, after which the posterior vaginal wall is freed and the uterosacral ligaments dissected (Fig. 1). They stand clearly as strong supporting structures, since they have usually hypertrophied because of prolonged stress in supporting the uterus. After these ligaments have been sufficiently dissected they are clamped, cut, and ligated at their junction to the cervix, but they are allowed to remain attached to the upper portion of the posterior vaginal wall. The sutures are cut long for use as guy ligatures. The posterior and anterior cul-de-sacs are then opened. Now the cardinal, broad, and round ligaments are successively approached and treated by clamping, cutting, and ligating them until the uterus is free and removed. The sutures on the round and upper broad ligaments are left long to serve as guy ligatures; tension on them is helpful in examining the adnexa at this time. If these organs are normal and no enterocele is noted, the peritoneum of the two cul-de-sacs is closed transversely with interrupted catgut sutures in such a way as to reduce the size of the posterior cul-de-sac (Fig. 2).

In the correction of the cystocele, and any co-existing urethrocele, the bladder is first separated from the anterior vaginal wall and the latter is cut in the midline to within one centimeter of the external urinary meatus. The pubocervical fascia is dissected from the vaginal mucosa on each side of the

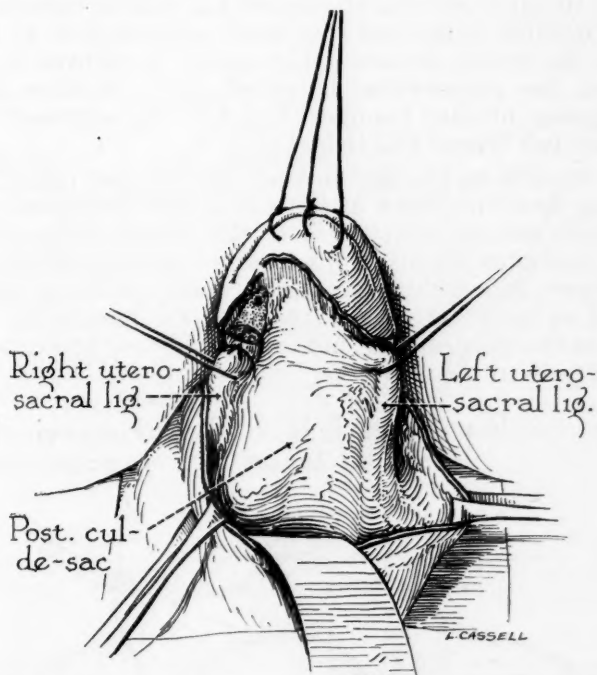


Fig. 1.—Schematic drawing of a prolapsed cervix showing three heavy silk sutures which have been placed through the anterior and posterior lips of the cervix so as to occlude the canal. The sutures are left long for the purpose of traction. After making an elliptical incision through the mucosa of the cervix just below the level of the bladder reflection, the insertion of the uterosacral ligaments to the cervix can be noted posteriorly. These ligaments are dissected, clamped, cut, and tied as seen on the right in this drawing.

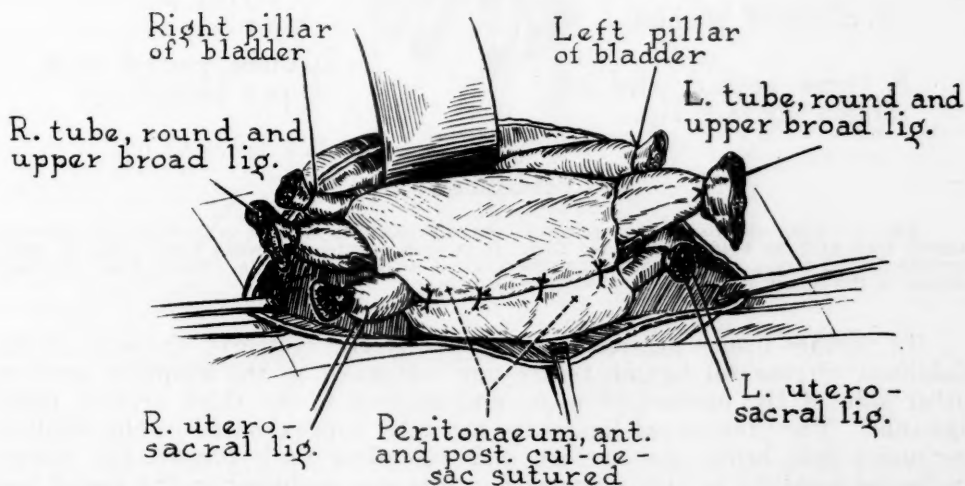


Fig. 2.—Following the routine vaginal hysterectomy, the peritoneal reflections of the anterior and posterior cul-de-sacs are approximated with a row of interrupted catgut sutures. At each lateral angle the cut edges of the broad and round ligaments can be seen to emerge from the peritoneal cavity. Lying extraperitoneally are the pillars of the bladder anteriorly and the uterosacral ligaments posteriorly.

herniation (Fig. 3). After advancing the bladder this hernia is then repaired with a series of Halsted mattress sutures of fine silk or chromic catgut begun just below the urethral orifice and continued posteriorly so as to approximate the fascia over the entire urethra. This series of sutures is continued posteriorly, bringing the pubocervical layers of fascia together in the midline, so as to support the infolded bladder (Fig. 4). The extremities of the pubocervical fascia are left free at this time.

By placing tension on the guy ligatures left on the round ligaments, it is possible to bring them into view at the site of the peritoneal closure. These ligaments are now sutured together over the closed peritoneum. Following this, the broad ligaments are also approximated in the midline by two or three interrupted sutures, and at this time the extremity of the pubocervical fascial sheet is sutured to them, effectually reducing the herniation of the bladder. Thus the fibers of the pubocervical fascia are anchored posteriorly to the other supporting structures of the pelvis.

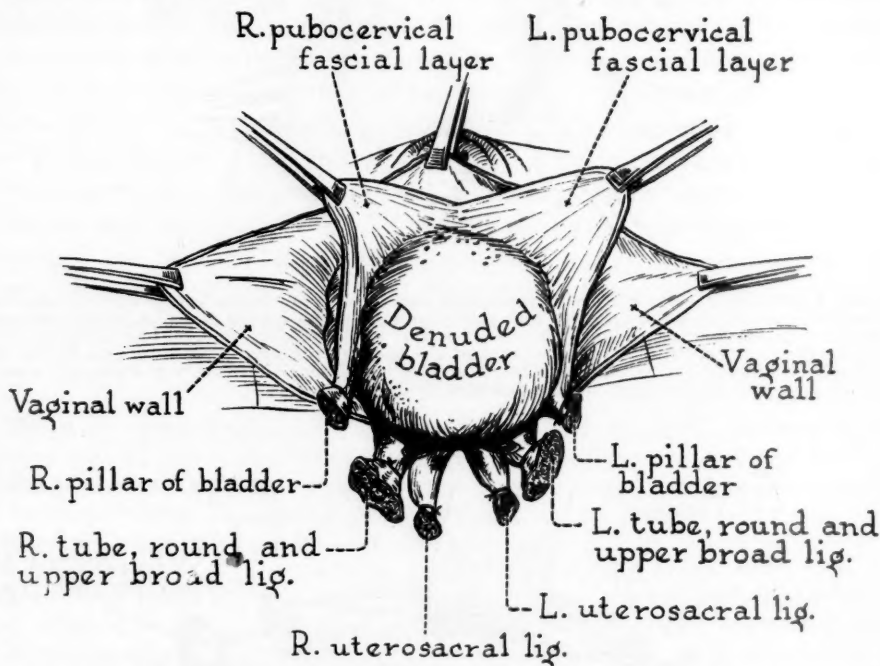


Fig. 3.—After closure of the peritoneal cavity a midline incision is made in the anterior vaginal wall and the bladder dissected free. It is then advanced upward and a flap of pubocervical fascial tissue is separated from the vaginal wall on each side. These flaps are later utilized in the repair of the cystocele and urethrocele.

To further insure against a recurrence of the cystocele, the ends of the mobilized uterosacral ligaments are now advanced to the subpubic arch on either side of the urethra (Fig. 5) and sutured to the thick arcuate pubic ligament. The uterosacral ligaments are then approximated in the midline, beginning just below the urethra and extending back toward the rectum as far as possible; in this process they also are anchored to the round and broad ligaments (Fig. 6).

This procedure obliterates the hernias of the anterior and posterior cul-de-sacs, and enhances the supporting structures of the anterior portion as well as the posterior portion of the pelvic floor. The uterosacral ligaments become a substantial accessory to the anterior fascia of the vagina. The same results

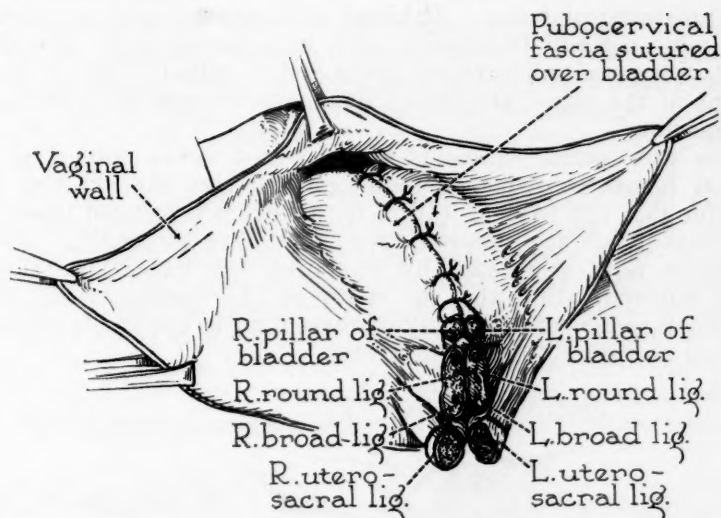


Fig. 4.—The cut edges of pubocervical fascia are approximated in the midline with interrupted chromic catgut sutures after the bladder has been advanced upward. The cut ends of the round and broad ligaments are then sutured together in the midline, and the cut ends of the pubocervical fascia, which include the so-called pillars of the bladder, are anchored to them for support.

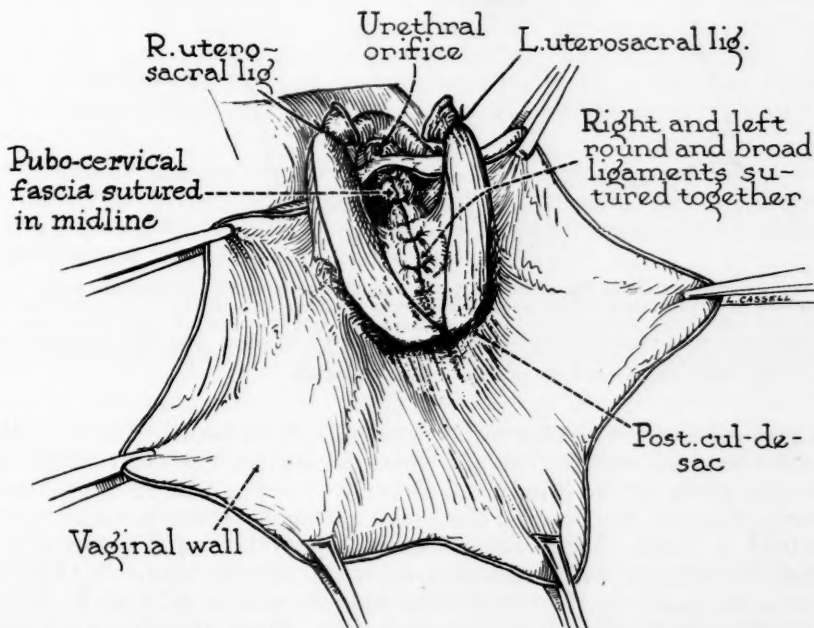


Fig. 5.—The cut ends of the right and left uterosacral ligaments, previously mobilized in part, are now further dissected so that they may be brought forward over the sutured broad and round ligaments and pubocervical fascia to the subpubic arch. They are next sutured to the strong arcuate pubic ligament on each side of the urethra, beneath the mucosa of the introitus, with silk or catgut mattress sutures. As an alternate procedure, the uterosacral ligaments may be placed deep to the pubocervical fascia, in which case the ends of the pillars of the bladder are sutured to them rather than to the stumps of the broad ligaments.

can be achieved by placing the uterosacral ligaments deep rather than superficial to the pubocervical fascia. Although this appears to be more anatomical, it is a little more difficult technically, and, in so far as it obviates the opportunity of attaching the pubocervical fascia and so-called pillars of the bladder to the stumps of the round and broad ligaments, it appears to us to be a less desirable procedure.

When the uterosacral ligaments are extended to the pubic arch, the posterior vaginal fornix is displaced tending to shorten the anterior wall. To compensate for this, the vaginal wall at the fornix is separated from the uterosacral ligaments which are dissected free as far back as needed. The anterior colporrhaphy is now completed by trimming the excess anterior vaginal mucosa and approximating the cut edges in the midline with interrupted sutures of fine chromic catgut; many of these sutures are so placed as to catch the underlying uterosacral ligament layer.

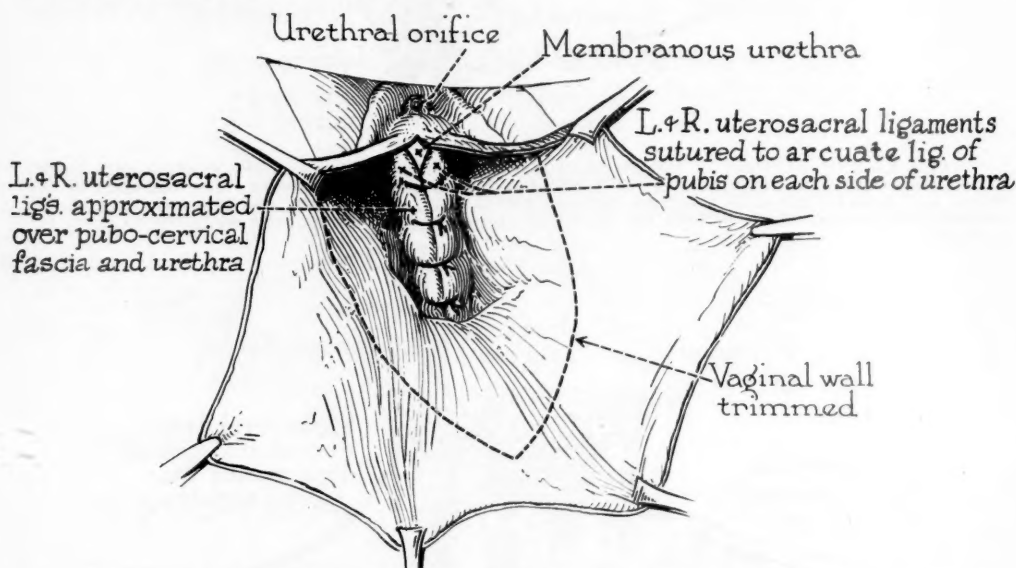


Fig. 6.—After the ends of the uterosacral ligaments are fixed to the arcuate pubic ligament, their free edges are approximated in the midline with interrupted sutures, beginning just back of the urethra and extending upward as far as possible toward the rectum. As they pass over the stumps of the round and broad ligaments they are anchored to them. The excess vaginal mucosa is then excised and the cut edges approximated in the midline. The rectocele and relaxed perineum are repaired in a routine manner to complete the operation.

The rectocele now remains to be repaired. It is well to leave an inch or two of intact vaginal wall for the new posterior wall in the vault of the vagina. To serve as a guide in the dissection, an Allis clamp is placed at that level on the posterior vaginal mucosa and the usual rectocele repair is made. A transverse incision is made at the mucocutaneous junction of the posterior fourchette, and the vaginal wall separated from the rectum up to the Allis clamp serving as a landmark in the vault. The vaginal wall is split up to that point and the levator ani fascia exposed on each side. These structures are approximated in the midline with interrupted medium weight catgut sutures from above down, sometimes in two or more layers to assure adequate pelvic floor support. Likewise, the perineal body structures on each side are approximated in the perineorrhaphy. The excess posterior vaginal wall is excised as a triangle with the apex in the vault, and the edges are brought together with interrupted fine chromic sutures picking up the underlying structures to obliterate "dead space."

Complications and Postoperative Care

The vagina is packed loosely at the time of operation to prevent adhesions between the anterior and posterior suture lines; the pack is removed forty-eight hours postoperatively. A Foley bag catheter is inserted before the patient leaves the operating room to determine the amount and character of urine, and to rule out operative trauma to the urinary tract, as well as to drain the bladder.

Until recently a majority of the patients operated upon complained of dysuria and frequency as a result of urinary infections which commonly developed. This complication has been minimized by leaving the Foley retention catheter in place for five to seven days to provide constant drainage. It is then removed and the patient requested to void at least once every six hours; if unable to void, she is catheterized. After voiding the patient is catheterized to note the amount of residual urine; this is continued until one ounce or less of urine is obtained on three consecutive catheterizations. In cases of urinary infection, small doses of oral sulfadiazine are given, which usually effect a prompt cure.

Hematomas or infected hematomas constitute the next most frequent complication. These usually rupture spontaneously, some as late as ten days postoperatively. They may be discovered by palpation under sterile precautions, and, if found, they are opened with a blunt instrument either under hypodermic narcosis or light intravenous pentothal anesthesia. Secondary hemorrhages which required treatment were also occasionally encountered. These patients were returned to the operating room and under intravenous pentothal anesthesia the bleeding points were ligated. In each case the bleeding arose from the posterior vaginal mucosa. Improved surgical technique based on the principle of approximation rather than strangulation of tissues plus better hemostasis through careful ligation of all individual bleeders has today practically overcome the problems of hematoma formation and secondary hemorrhage.

Pelvic infections or wound infections not related to hematoma formation occur relatively rarely. In our series of over 100 cases, only three such infections were encountered, and they were all readily controlled by the use of sulfonamides and more recently parenteral penicillin.

Results

An accurate evaluation of the end results of the operation herewith described is limited by the fact that this technique has been employed for only the past four years. The publication of this paper was postponed for one year in order to better evaluate the end results which at this time are very gratifying. Up-to-date studies of one hundred and four cases, ranging from eighteen months to four years postoperatively, show only two failures: one recurrent cystocele and one postoperative enterocele. In no case was vaginal function unsatisfactory postoperatively. There were no resultant vaginal fistulas. No cases of thrombophlebitis, pulmonary embolism, or postoperative pneumonia were encountered. There were no deaths in this series.

Summary

Third degree herniation of the pelvic viscera constitutes a disabling disease entity for which many procedures of operative repair have been devised, none of which to date have proved completely satisfactory. Herewith is presented a new modification of repair following vaginal hysterectomy which utilizes an advancement of the uterosacral ligaments to the pubic arch. It is

carried out according to the principles of any hernia repair wherein the sacs are obliterated and the fascia and muscle reconstructed. It not only supports the pelvic viscera, but also preserves the natural function of the vagina. In the hands of the authors the method herein described has proved very effectual to date; however, the ultimate end results of this procedure can be evaluated only as a larger series of cases is treated in this manner and more time is allowed to properly evaluate their late postoperative findings.

References

1. Adair, F. L., and Da Sef, L.: *AM. J. OBST. & GYNEC.* 32: 218, 1936.
2. Baer, J. L., Reis, A., and Laemle, R. M.: *AM. J. OBST. & GYNEC.* 34: 827, 1937.
3. Barrett, C. W.: *Am. J. Surg.* 59: 519, 1943.
4. Barrett, C. W.: *West. J. Surg.* 53: 354, 1945.
5. Barrett, C. W.: *Am. J. Surg.* 71: 167, 1946.
6. Bissell, D.: *Surg., Gynec. & Obst.* 78: 138, 1919.
7. Bovee, J. W.: *Tr. Am. Gynec. Soc.* 37: 118, 1912.
8. Curtis, A. H., Anson, J., and McVay, B.: *Surg., Gynec. & Obst.* 68: 161, 1939.
9. Curtis, A. H., Anson, J., and Beaton, E.: *Surg., Gynec. & Obst.* 70: 643, 1940.
10. Curtis, A. H., Anson, J., and Ashley, F. L.: *Surg., Gynec. & Obst.* 74: 708, 1942.
11. Curtis, A. H., Anson, B. J., Ashley, F. L., and Jones, T.: *Surg., Gynec. & Obst.* 75: 421, 1942.
12. Curtis, A. H., Anson, B. J., Ashley, F. L., and Jones, T.: *Surg., Gynec. & Obst.* 75: 743, 1942.
13. Curtis, A. H.: *Urethrocele, Cystocele and Uterine Prolapse. Nelson Loose-Leaf Surgery* 7: 337, 1937.
14. Farrar, L. K. P.: *AM. J. OBST. & GYNEC.* 2: 395, 1921.
15. Frank, R. T.: *Surg., Gynec. & Obst.* 24: 42, 1917.
16. Frank, R. T.: *AM. J. OBST. & GYNEC.* 5: 8, 1923.
17. Goff, J. R.: *Am. J. Obst.* 62: 611, 1910.
18. Jellett, H.: *Surg., Gynec. & Obst.* 13: 206, 1911.
19. Kelly, H. A.: *Prolapse of Urethra and Incontinence. Kelly Gynecology*, 82, 1928.
20. Kennedy, W. T.: *AM. J. OBST. & GYNEC.* 20: 51, 1930.
21. Masson, J. C.: *J. A. M. A.* 99: 1143, 1932.
22. Mayo, C. H.: *Surg., Gynec. & Obst.* 20: 253, 1915.
23. Noble, G. H.: *Tr. Am. Gynec. Soc.* 37: 115, 1912.
24. Power, R. M. H.: *AM. J. OBST. & GYNEC.* 38: 27, 1939.
25. Richardson, E. H.: *AM. J. OBST. & GYNEC.* 34: 814, 1937.
26. Sears, N. P.: *AM. J. OBST. & GYNEC.* 29: 834, 1935.
27. Shaw, W. F.: *AM. J. OBST. & GYNEC.* 26: 777, 1933.
28. Spalding, A. B.: *Surg., Gynec. & Obst.* 29: 529, 1919.
29. Sturmdorf, A.: *Gyno Plastic Technology*, Philadelphia, 1919, F. A. Davis Co.
30. Vineberg, H. N.: *Tr. Am. Gynec. Soc.* 46: 81, 1921.
31. Watkins, T. J.: *Am. J. Obst.* 65: 225, 1912.
32. Watkins, T. J.: *Surg., Gynec. & Obst.* 40: 687, 1925.
33. Wertheim, E.: *Zentralbl. f. Gynäk.* 23: 369, 1899.

Discussion

DR. JOSEPH L. BAER.—Concerning the substance of the article, there are a few comments which should be registered. Dr. Kooistra says that it is generally agreed that the numerous operations commonly used for the repair of third degree pelvic herniation, popularly called uterine prolapse, are not completely satisfactory, since recurrence of the herniation is common, and because an unsatisfactory vagina is frequently the end result. If his conclusions are predicated on that premise then, of course, one must take issue. In my own experience, the end result has not been commonly unsatisfactory. On the contrary, with the procedures which I shall outline rather briefly recurrence of cystocele or vaginal prolapse is so unusual that I have no present recollection of any such, and the foreshortening of the vagina from the standpoint of marital relations has yet to come to my notice.

Vaginal herniation of the pelvic viscera is in general dependent upon damage to the fascial structures which support those viscera. It was learned that muscle approximation and utilization of the muscles for the correction of herniation of any kind was futile; that good results are to be obtained only and if fascia is included. Here we are dealing with the endopelvic fascia which extends from the symphysis and descending rami of the pubis to the cervix, laterally to the pelvic wall and posteriorly to the junction of the second and third sacral vertebrae. Parts of this fascial plane are the cardinal ligaments and the uterosacral ligaments. A break-through of the bladder must be corrected by the reconstruction of that fascial plane.

The two general conditions which we may find in the elderly woman in whom we have decided to remove the uterus as part of the cure of her procidentia may be either that the supporting structures, which are overstretched, can be brought together very readily transversely, or can be brought together anteroposteriorly. From the standpoint of cure of prolapse it makes very little difference. A good deal of importance has been attached to imbrication of the broad ligaments and cardinal ligaments after removal of the uterus in order to give the bladder and pelvic contents proper support. Yet in the clamp hysterectomy, the uterus is removed in three minutes or less; the clamps are left attached for forty-eight hours. After forty-eight hours with the clamps removed those women subjected to a three-minute hysterectomy have a complete cure. They have no prolapse and no dyspareunia. There was no subsequent prolapse, and no need for having brought the ligaments together in the midline. The Mayo Clinic technique, which has wide popularity, of imbrication of the cardinal ligaments is splendid when those ligaments are adequate and sufficiently elongated so that they can be approximated transversely.

Good results also seem to be obtained by uniting the round ligaments, cardinal ligaments and uterosacral ligaments on one side and then uniting the same three structures on the opposite side with little or no attempt to bring them together in the midline, so long as the peritoneal cavity is closed and the vagina reconstructed.

Dr. Kooistra has offered for consideration a procedure whereby, after midline approximation, the uterosacral ligaments are brought upward and anchored under the rami of the pubis. I see no objections to this. I must confess that I cannot agree with his statement that because these structures are overstretched, they are prone to become thickened. Overstretched and atrophic muscle fibers of the uterosacral ligaments and round ligaments do not hypertrophy. Nevertheless, it is wise to make use of them and their fascial accompaniment in whatever way one chooses.

DR. A. E. KANTER.—I have been using a technique very similar to this for a number of years and I believe it answers the purpose as well as any. I do not say it is better than any other procedure, but it does answer the purpose.

Dr. Kooistra lays a great deal of stress on the uterosacral ligaments and, as Dr. Baer showed, cutting the uterosacrals has very little effect on the uterus. It is not the uterosacral but the cardinal ligaments that keeps the uterus from descending.

I have done this operation on a patient as old as 80 years; it carries with it very little shock, and certainly is very superior to the Le Fort operation. It carries very little morbidity and no mortality if you study the blood chemistry. If the patient has nitrogen retention in the blood stream and the kidneys do not function properly, this operation carries a little more pressure on the uterus than do other procedures, and such a woman may not be able to stand the operation. If the blood chemistry is normal, I have no hesitancy in doing the operation.

The biggest problem is the question of retaining the serviceability of the vagina. In doing this operation, I measure the length of the vagina and determine how long I am going to leave it. The first incision is through the mucous membrane only; a T-incision which is extended upward. I am conscious of the fact that the bladder has prolapsed almost to the tip of the uterus, so I work the mucous membrane down until I see the pillars of the bladder, which I cut across. The bladder is then pushed up and a retractor inserted to hold it in place.

Then I do a vaginal hysterectomy. When I am through I have mobilized the mucous membrane of the vagina, the peritoneum anteriorly, the peritoneum posteriorly. The next step is to take care of the bladder. We start plicating the tissues along the urethra and along the bladder itself. When we are ready to support the structures, the peritoneum is picked up first and then the round ligament which is followed to the suprapubic or urogenital diaphragm, depending upon how broad the arch of the pubis is. In closing the peritoneal cavity, the round ligament, the cardinal ligament, and the peritoneum are united, which finally brings peritoneum to peritoneum. Dr. Kooistra sewed the two round ligaments; I tie them. I tie the two uterosacrals and remove the redundant mucous membrane and bring the two edges together with perineorrhaphy to finish the operation.

Since using this technique we have had no recurrence of cystocele, no peritonitis, no embolic phenomena.

DR. KOOISTRA (Closing).—Dr. Baer takes exception to my use of the word "common." When the literature shows from 4 to 30 per cent recurrences, in one form or another, I think the use of the term "common" is permissible. I agree with him that the reconstruction of the fascial plane is indeed important. I believe that the uterosacral ligament is not as much of a definite ligament as it has been considered in the past; in the anatomic laboratory we find that this ligament thins out pretty much as you proceed backward toward the sacrum and when you draw it forward, you are not only pulling forward one individual ligament but part of the cardinal ligament and all of the endopelvic fascial structures alongside of it as well. We use the uterosacral ligaments in the repair of our second and first degree prolapses; in those cases where the ligaments are long enough we pull them forward to the pubic arch; when we cannot do that, then we use the procedure described by Dr. Baer.

I find Dr. Kanter's technique very interesting. I think he obtains about the same results that we do. The only difference in the end results is that in his operation round ligaments are sutured to the ligamentous attachments on the pubis, whereas we attach them to the broad ligament and approximate all these structures together in the midline.

CARCINOMA OF THE CERVIX

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IT IS the purpose of this study to present a statistical analysis of facts concerning all patients with a proved diagnosis of cancer of the cervix uteri treated in this clinic from 1933 through 1944. Although the series is relatively small, this study will afford a base line for future investigation and will give some indication of the success or failure of treatment to date and thereby afford a means of comparison for results of future and hopefully better therapy. In presenting this data, an effort has been made to conform to the rules and pattern of presentation and analysis as outlined by the League of Nations Annual Report of 1935.

All cases of cancer of the cervix and cervical stump microscopically diagnosed as such from 1933 through 1944 have been reported with the following qualifications:

1. All cases of intraepithelial and questionable cancer have been excluded.
2. All patients who, after a definite diagnosis, refused treatment have been excluded.
3. Those patients in whom the cancer was too far advanced to warrant treatment have been included.
4. All patients lost in the follow-up have been counted and assumed dead.

Taking the above qualifications into consideration, it has been possible to report on 212 patients, 115 of whom have been followed for at least five years. This latter group includes all patients seen from the middle of 1933 through 1940.

Of the remaining 97 patients seen from 1941 through 1944, it is possible to report four-, three-, two-, and one-year survival rates from which some indication as to the relative success or failure of therapy in these years as compared with former years can be acquired. This comparison is particularly relevant because of the fact that late in 1939 our dosage and technique of administering x-ray were altered.

The patients have come from four sources. The majority have come from the gynecologic outpatient department, presenting themselves with complaints, many of which were not related specifically to the cervical lesion. It has been our practice to do biopsies on all cervical lesions that are even slightly suspicious of cancer, and a sizable number of our patients with early cancer were found in this fashion. A small number were referred to the clinic with a known diagnosis, either from the other departments in this hospital or from outside physicians. Finally, there was a group of patients found to have cancer after an operative procedure for another condition. There are several cases

on whom subtotal hysterectomies were performed for myomas, and subsequent pathologic examination revealed the presence of carcinoma originating in the cervix. As a result of this experience we stress the necessity of careful inspection of the cervix before subtotal hysterectomy is performed, with biopsy of all cervical lesions which are even vaguely suspicious of malignancy.

All patients with pathologically proved cancer of the cervix were admitted to a hospital floor separate from the other gynecologic patients. Each received a thorough physical examination, and under those circumstances where the pelvic examination was considered unsatisfactory, it was done under anesthesia. The pelvic findings were divided into the clinical stages as outlined by the League of Nations. In an effort to standardize clinical classification, the same senior members of the permanent staff examined all patients whenever possible.

When it was doubtful as to which stage a given case should be allocated, the earlier one was chosen. Investigations of the genitourinary and gastrointestinal tracts were carried out in all cases where indicated. Treatment was instituted in every instance while the patient was hospitalized. The value of hospitalization is twofold: first, it assures that the patient carries through with the whole treatment; and second, it affords a better opportunity for the early recognition and prompt treatment of undesirable side effects of radiation.

There were 212 patients handled in the above fashion from 1933 through 1944. The youngest patient was 24 years old, the oldest 83 years of age. Fig. 1 indicates the age range according to decade. The majority of the patients were between 30 and 60 years of age, and were almost equally represented in the fourth, fifth, and sixth decades. Nine patients were under 30 years, representing 4.3 per cent; ten were over 70 years of age. Eighty-six and five-tenths per cent of the patients had borne children; the largest percentage had had two. Thirteen and five-tenths per cent were nulliparous.

Fig. 2 shows the duration of symptoms. Accurate determination as to the duration of those symptoms, which were specifically related to the cancer, was, of course, not always possible. Approximately 74 per cent of the patients had symptoms for six months or less, 38 per cent for three months or less, and 10 per cent had no symptoms. The largest number of patients had symptoms for three months or less.

A definite pathologic diagnosis of adenocarcinoma of the cervix was made in 17 cases, an incidence of 7.9 per cent. It is interesting that in five of these cases a diagnosis of adenocarcinoma of the fundus was made after curettage, and a panhysterectomy and bilateral salpingo-oöphorectomy subsequently performed. Pathologic study revealed the carcinoma to be of cervical origin. It has not been our practice to do fractional curettages, and perhaps such a procedure would have helped avoid this error.

There were 12 cases of cancer of the cervical stump. Three of these were discovered immediately after subtotal hysterectomy by pathologic study, one was discovered two months after operation, and the remaining eight cases were found two years or more after hysterectomy. These eight may be considered as true cases of cancer of the cervical stump if we are correct in assuming that the lesion was not present at the time of operation, an incidence of 3.8 per cent. Specifically, three of the eight patients had had a hysterectomy slightly over

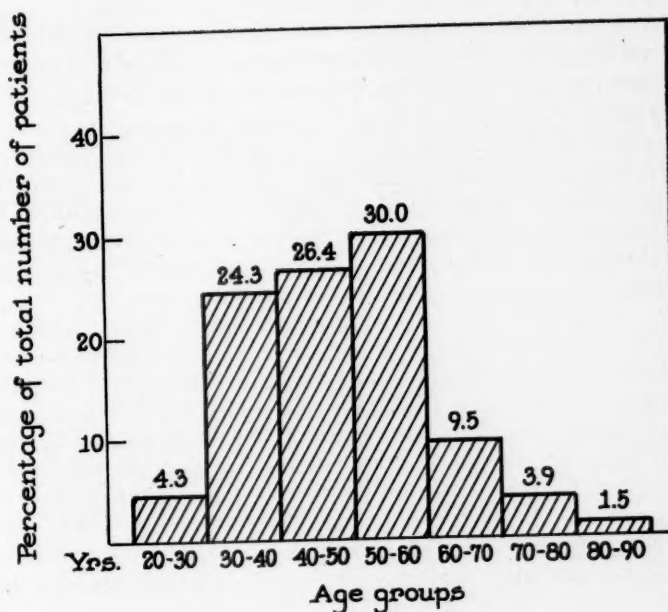


Fig. 1.—Age distribution in decades.

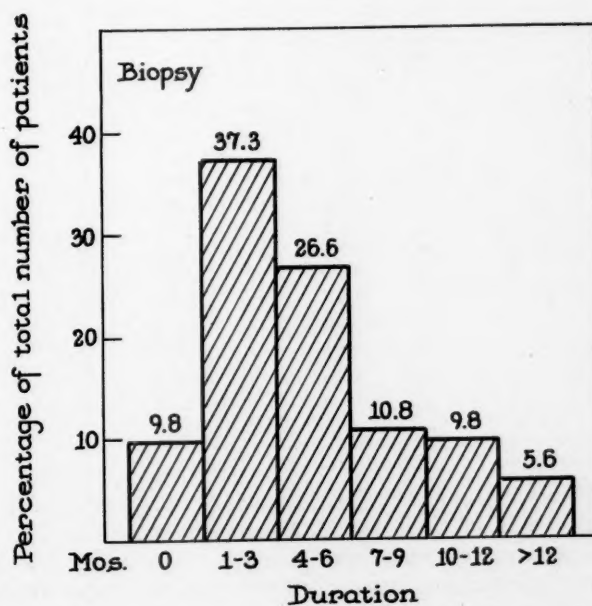


Fig. 2.—Duration of symptoms.

two years before the cancer was found; two patients, three years; one patient, five years; one patient, eleven years; and one patient, nineteen years before.

There were two cases of cervical cancer complicated by pregnancy. One was discovered in the third month, the other in the seventh month of gestation. There were two cases in which the cancer was found four and five weeks post partum, presumably present in both during the latter part of the pregnancy.

It is now generally believed that histologic classification is of questionable value in making a prognosis in cervical cancer. In our series there was no apparent correlation between histologic classification and survival rate. Of far greater significance is the clinical classification as outlined above. As is borne out in this study, the prognosis depends in most cases on the stage of the disease when the patient is first seen. If the malignancy has not spread beyond the cervix, that is, a Stage I, the chances for salvage are good, while at the other extreme, Stage IV, with the carcinomatous process invading the bladder or rectum or extending out of the true pelvis, the prognosis is invariably hopeless. Table I shows in detail the number and percentage of cases in each stage. In the 115 cases treated from 1933 through 1940, on whom a five-year salvage rate can be reported, about 25 per cent of the cases were in Stage I, 41 per cent were in Stage II, 24 per cent in Stage III, and 10 per cent in Stage IV. In this group, then, 66 per cent, or two-thirds of the cases, were in Stages I and II. Similarly, in the cases treated from 1940 through 1944, 63 per cent, or approximately two-thirds, were in Stages I and II. In contrast to the figures reported from various city hospitals and free institutions, our series shows a higher percentage of early carcinomas, and consequently our patients were in better physical condition when first seen. The number of patients who had suffered exhausting hemorrhages before admission was small, as was the number who were suffering from severe extragenital disease.

TABLE I. CLASSIFICATION OF PATIENTS INTO CLINICAL STAGES

YEAR	TREATED	LOST	STAGE I		STAGE II		STAGE III		STAGE IV	
			NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
1933-1934	16	1	4	25.0	9	56.0	2	12.5	1	6.3
1935	16	0	5	31.1	5	31.1	5	31.1	1	6.3
1936	15	3	3	20.0	7	46.6	4	26.6	1	6.7
1937	18	0	3	16.6	8	44.4	5	27.8	2	11.1
1938	18	1	4	22.1	6	33.3	4	22.1	4	22.1
1939	18	1	8	44.5	7	38.8	2	11.5	1	5.6
1940	14	0	2	14.5	5	35.8	5	35.8	2	14.5
Total	115	6	29	25.1	47	40.8	27	23.4	12	10.4
1941	28	0	11	39.5	10	35.4	6	21.2	1	3.7
1942	20	0	7	35.0	6	30.0	6	30.0	1	5.0
1943	25	0	6	24.0	7	28.1	10	40.0	2	8.0
1944	24	0	4	16.6	10	41.5	9	37.5	1	4.1
Total	97	0	28	28.9	33	34.0	31	32.0	5	5.2

As stated above, all of our patients were hospitalized during the initial stages of therapy, at least. Of the 212 patients in the series, 169, or approximately 80 per cent, were treated with x-ray and radium. Because the x-ray is utilized to combat the parametrial infiltration which will eventually cause the patient's death if unchecked, it was given first in most instances. Further advantages of this regimen of treatment are that the x-ray aids in clearing up infection and reduces the size of the tumor, thereby making the insertion of radium easier and more effective. Since 1940, the x-ray radiation factors have been appreciably changed: 250 kilovolts have been substituted for 200, fil-

ters of $\frac{1}{2}$ mm. copper and 1 mm. aluminum for the Thorius filter formerly used, and the skin target distance has been increased from 50 to 70 centimeters. For the greater distance a longer irradiation time is necessary to deliver a specified amount of radiation to the skin, but when this has been done the depth dose has been proportionately increased. It is now our practice to give an average of 2,200 r's in air to each of six pelvic ports and to an intravaginal port. In those cases where the intertrochanteric distance was too great to justify the use of the lateral ports because the depth dose would have been negligible, two anterior and two posterior ports alone were used. The anterior ports measured 11 by 14 cm., the posterior 12 by 15, and the lateral 10 by 14 cm. The use of the intravaginal port, started in 1940, has aided considerably in reducing the size of the tumor and clearing up infection before the insertion of radium. The massive dose technique has been replaced by the fractionated or divided dose method, for, as shown by Arneson,¹ the total amount of roentgen radiation delivered to the parametrium in the divided dose technique is much greater than that given by the massive dose method. It is now our practice to administer 200 r's to each of two portals daily in place of the 500 r's formerly given. Generally, it can be said that the changes in the x-ray factors were made in an effort to administer greater depth doses with fewer secondary reactions.

In most cases the radium was given one month after the last x-ray treatment. The advantages gained in waiting this period of time are that the maximum shrinkage of the tumor is allowed to occur, and the patients seem to tolerate the radium better with fewer side effects. The average intracavitary dose has been 3,600 mg. hr., in the form of one 100 mg. and one 50 mg. capsule of radium filtered with aluminum and monel metal, in rubber tubing. We have used interstitial $12 \frac{1}{2}$ mg. needles in selected cases.

Twenty-four patients received x-ray alone. This group for the most part represented advanced cases in which radium could not be used because of the presence of severe infection or hemorrhage or would have been of little value in prolonging the patient's life. Two Wertheim operations were performed, one being followed by x-ray. Panhysterectomy and bilateral salpingo-oophorectomy followed by x-ray were performed on five patients, and radium followed by panhysterectomy in one instance. All of these six surgically treated patients had adenocarcinoma of the cervix, and in the five cases treated with operation first, a diagnosis of adenocarcinoma of the corpus uteri had previously been made. The remaining cases were treated as follows: radium alone, two; amputation, two; amputation and x-ray, three. There were four cases not treated because the disease was too far advanced. In summary, as is shown in Table III, all but 17 of our patients were treated with some combination of x-ray and radium, or x-ray alone, or by radium alone.

TABLE II. CLASSIFICATION OF PATIENTS ACCORDING TO TREATMENT USED 1933-1944

X-ray and radium	169
X-ray	24
Wertheim operation	1
Wertheim and x-ray	1
Panhysterectomy, bilateral salpingo-oophorectomy and x-ray	5
Radium and panhysterectomy	1
Radium	2
Amputation of the cervix	2
Amputation and x-ray	3
Not treated	4
Total	212

TABLE III. A COMPARISON OF LATE RADIATION REACTIONS OCCURRING BEFORE AND AFTER 1940—115 PATIENTS BEFORE, 97 PATIENTS AFTER

REACTION	1934-1940	1941-1944
Bladder (cystitis)	9	4
Rectum (proctitis)	6	6
	4	0
Skin (telangiectasis, ulceration and pigmentation)	1	1
	2	3
Fistula formation		
Vesicovaginal	3	1
Rectovaginal	1	1
Sigmoidvaginal	1	
Obstruction of the ureters	1	1 (partial)
Fracture of the femur	2	
	30	17

To date there have been 47 cases of late radiation reactions, an incidence of 22.1 per cent. These are summarized in Table III. The most common late complication in our series has been bladder injury. Dean² has accurately described late ulcerative lesions occurring in the bladder following irradiation of the uterus. He recognizes three types of lesions: a primary erythema occurring within twenty-four hours after treatment and being a nonspecific reaction to local irritation; secondary erythema appearing within a month after treatment and being a specific reaction to irradiation, probably due to temporary vasodilatation; and a tertiary reaction consisting of obliterative endarteritis with sloughing and ulceration of the tissues, rarely appearing earlier than a year, sometimes as late as ten years after treatment. Everett³ has reported that the presence of lesions of the upper urinary tract before treatment in patients with cancer of the cervix is of grave prognostic significance, and that approximately 50 per cent of these patients, after treatment, show evidence of some obstructive lesions involving the lower ureters with resulting dilatation of the kidney pelvis and ureter. Everett states that in only about 15 per cent of these patients are the lesions of sufficient severity to be of clinical importance, but that this incidence is sufficiently high to render routine urologic study a justifiable and important part of the follow-up. In our study there were nine cases between 1934 and 1940 and four from 1941 through 1944, all manifested by symptoms of chronic cystitis with or without hematuria. Unfortunately, no careful urologic study was made in these cases. Numerous instances of mild cystitis occurred during treatment, but symptoms usually disappeared within a month or two. In only one patient apparently cured of cancer did obstruction of the ureters occur necessitating transplantation.

Injury to the rectum resulting in proctitis was the second most frequent complication. Radiation effects upon the rectal mucous membrane result in definite clinical signs which vary in proportion to the intensity of radiation.⁴ A number of patients had a mild diarrhea during the latter part of therapy. The symptoms varied from watery diarrhea with two to four stools daily to severe abdominal pain, tenesmus, and frequent stools. With the improved technique, the incidence of this early complication has been appreciably reduced. Other gastrointestinal symptoms of nausea, vomiting, and anorexia have been combated with the use of 50 mg. of pyridoxine daily. We can make no definite statement, at this time, as to the therapeutic effectiveness of this drug. There have been 12 cases of late protracted proctitis, manifested by diarrhea and tenesmus. In these instances, ischemia with fibrosis and scarring of the rectum has probably occurred. Proctoscopy was carried out where there was any question of tumor recurrence in the rectum.

Skin reactions consist of an early epidermitis which expresses itself as a moist denuded area caused by a complete loss of the superficial layers of the epidermis.⁴ Such early reactions have not complicated our cases, as dosages sufficient to produce them are not possible if more serious injuries to the bladder and intestines are to be avoided. Late skin changes consist of telangiectasis, atrophy, pigmentation, and, in extreme cases, ulceration. There were seven serious skin reactions between 1934 and 1940, and four between 1940 and 1944. Specifically, there were two cases of ulceration, four of telangiectasis, and five of severe pigmentation.

Seven cases of fistulas occurred. In these, growth of the tumor with ulceration through the bladder or rectum was probably the main etiologic factor, rather than the radiation. There were three instances of vesicovaginal fistula up to 1940 and one case after that time. Rectovaginal fistula developed in one patient seen before, and one seen after 1940. One instance of sigmoid-vaginal fistula developed.

Two patients experienced fracture of the femur, presumably as a result of a sclerosing osteitis from the radiation.

It has been said that infection during the course of irradiation is by far the most important complication associated with radiotherapy of cancer of the cervix,⁴ the 2 per cent mortality charged against this procedure being due almost entirely to the activation of hemolytic streptococci by the radiation. Furthermore, it is generally believed that the presence of infection makes the tumor more radioresistant. Occasionally pelvic infections, particularly those resulting from streptococci, have made it necessary to diminish the quantities of x-ray given in the individual treatment and to prolong the time over which the therapy is given. Usually, however, it has been possible to continue treatment in such patients despite considerable febrile reaction. Several cases of early pyometria resulting from occlusion of the cervical canal have occurred in this series, as well as several cases of late pyometria and late infectious parametritis. Whereas a complete study of morbidity, duration of hospital stay, and the effects of the intravaginal port and chemotherapy on infection complicating radiation will be reported at a later date, certain general trends may be described; namely, the incidence of early febrile reactions has been diminishing, and the severity of such reactions has been markedly reduced since the advent of chemotherapy.

It is doubtful if this summary represents all the late reactions that actually occurred, for many of our cases are sent to homes for terminal care as soon as it is evident that the prognosis is hopeless, and it has been impossible for these overcrowded institutions to provide us with complete clinical abstracts.

Follow-up.—All the patients after discharge were followed in a special radiation clinic and seen as frequently as indicated, never at an interval greater than a year. With the help of an efficient social service department, we have been able to follow to date 206, or approximately 97 per cent, of the 212 patients in this series. The whereabouts and physical state of the remaining six patients at the moment are not known. It is to be noted that only with a great deal of effort and time has it been possible to trace and contact certain patients. The same senior member of the staff, who sees these patients on admission and advises treatment, has charge of the radiation clinic, and when possible he personally sees them all. In this work he has been assisted by various members of the house staff.

Results

Survival rates are summarized in Table IV. There were 115 patients followed for at least five years. Because it has been impossible for us to deter-

mine in the largest percentage of cases the actual cause of death, due to the fact that most died at home or in homes for terminal care, we have assumed that all died of cancer. Forty-nine patients, or 42.5 per cent, survived for at least five years. Of these 49 patients, 44 were classified as Stages I or II when first seen; specifically, 23 were Stage I and 21 Stage II. Of this group of 115 patients, 51, or 44.3 per cent, survived four years, and 59, or 51.4 per cent, at least three years. The observation that there is a small difference between four- and five-year survival rates, and only a slightly greater difference between three and five years, indicates that if a patient survives three years, her prognosis is certainly favorable. As yet it is impossible to make any conclusive statements about late recurrences. There were 76 of these 115 patients who were originally classified as Stage I or Stage II, and of these 44, or 58 per cent, survived at least five years and represent 90 per cent of the patients who survived for the five-year period. These figures indicate that a patient classified as having Stage I or Stage II cancer of the cervix had almost a 60 per cent chance of living five years, whereas a classification of Stage III or Stage IV carries a hopeless prognosis beyond this period.

It is of some interest to study the yearly survival rates of those 97 patients seen after 1940, when radiation factors were changed, as outlined above. It has been pointed out that the percentages of cases in Stages I and II remained relatively constant through the years, and thus this group is comparable to that seen before 1941. There seems to be a slight improvement in one-year survival rates from 1941 through 1944, as compared with the period from 1938 to 1940, although none over 1934 to 1937 results.

TABLE IV. RESULTS

YEAR	TREATED	LOST	PERCENTAGE ALIVE AFTER—YEARS									
			1	2	3	4	5	6	7	8	9	10
1933-1934	16	1	100.0	100.0	68.5	62.5	62.5	56.5	56.5	50.0	50.0	43.8
1935	16	0	75.0	56.5	56.5	56.5	50.0	50.0	50.0	43.8	43.8	
1936	15	3	86.5	60.0	40.0	33.3	26.8	26.8	20.0	20.0		
1937	18	0	83.5	72.1	51.5	51.5	51.5	51.5	50.0			
1938	18	1	66.8	38.9	33.3	33.3	33.3	33.3				
1939	18	1	66.8	50.0	44.5	38.9	38.9	33.3				
1940	14	0	64.5	64.5	57.0	28.3	28.3					
Total	115	6			51.4	44.3	42.5					
1941	28	0	86.1	57.0	46.5	35.4						
1942	20	0	65.0	45.0	45.0							
1943	25	0	80.0	60.0								
1944	24	0	87.5									
Total	97	0										

Our results are comparable to those in recent reports from other clinics. It is to be noted that unless the percentages of early cases in various series are approximately the same, end results expressed in survival rates are not comparable. Smith and Dresser⁵ report a 38 per cent salvage rate from 1929 through 1933, and a 43 per cent rate from 1934 to 1938. McLennan⁶ reports an over-all relative rate of 26.4 per cent. Garcia and Schlosser⁷ report a five-year survival rate of 28 per cent. It is to be noted that two-thirds of the latter authors' series were classified as Stages III and IV. Healy and Twombly,⁸ using about the same technique at the Memorial Hospital as outlined above, report a 35.4 per cent survival rate. The combined international figures, as reported by the League of Nations, show a relative rate on 10,970 patients of 26.7 per cent.

Certain general statements can be made as a result of this study. In the first place there was no relation between age and survival rate; that is, the younger patients did not on the average live a shorter time than did the older ones. There was no relation between parity and survival rate or histologic classification and survival rate.

The largest percentage of our patients had symptoms less than three months. This is not remarkable if we take into consideration the fact that two-thirds of our patients had relatively early cancer of the cervix, that is, had lesions classified as Stage I or Stage II. It is to be noted that a relatively large group, approximately 10 per cent, had no symptoms that could be explained by the presence of the cancer when it was discovered. It is in these patients that the routine biopsy of cervical lesions not obviously malignant was so important in establishing the diagnosis. Certainly the value of careful inspection of the cervix in all patients and the free use of the biopsy cannot be over-emphasized, because the patient with an early carcinoma has about a 60 per cent chance of living five years, while the woman with an advanced lesion has practically no chance. Because progress in treatment is slow, great efforts must be made to effect earlier diagnoses, for in this way can we definitely improve end results. This study has shown that among our patients prognosis depends almost entirely on the stage of the disease at the start of treatment.

The relatively high incidence of 3.8 per cent of cancer of the cervical stump in our series of 214 cases of cancer of the cervix raises the argument of the value of total versus subtotal hysterectomy. Some authors feel that there is no justification for leaving a nonfunctioning cervix in place in those cases where it could be removed without appreciably lengthening the procedure or making it more difficult. Others are of the opinion that total hysterectomy results in a higher morbidity, shortening of the vagina, and even fistula formation in some instances and, therefore, should be reserved for those cases where the cervix is definitely diseased. It can be said that in every instance where the cervix is diseased and a total hysterectomy can be performed safely, such a procedure should be undertaken. If for any reason an unhealthy cervix is left in place, it should be treated postoperatively.

The use of the higher voltage with the divided dose technique, aluminum filtration and intravaginal port, although not resulting in any demonstrable trend toward higher survival rates, has been accompanied by a reduction in the incidence of late radiation reactions to about half, although it is too early to make a definite statement in this regard. In fact, Healy and Twombly⁸ report a higher instance of skin reactions and intestinal disturbances in cases treated with the divided dose method than in those treated with the massive dose technique. Later it will be possible adequately to evaluate the worth of the intravaginal port and the use of chemotherapy in reducing the incidence of infection and shortening the period of hospitalization. Because of the higher incidence of infection and the worse prognosis in patients from whose vaginae hemolytic streptococci can be cultured, prophylactic chemotherapy should be instituted in all cases where the hemolytic streptococci has been isolated on routine culture. Our general impression at this time is that a reduction in both morbidity and duration of hospitalization is being achieved by such means.

Summary

A statistical analysis of 212 patients with cancer of the cervix has been presented.

Of the total of 212 cases, 65 per cent were classed as Stage I or Stage II and 35 per cent as Stage III or Stage IV.

Of the 115 patients seen from 1933 through 1940, 49, or 42.5 per cent, survived for five years or more.

The four-, three-, two-, and one-year survival rates for the 97 patients seen from 1941 through 1944 are not appreciably different from the rates over the first period, i.e., from 1933 through 1940, despite the fact that in 1940 radiation factors and technique were altered.

There were 47 cases of late radiation reactions in the total group of 212 patients, an incidence of 22.1 per cent. There were about twice as many reactions in those patients treated before 1940 as in those treated after 1940. This reduction in radiation complications we attribute to improved technique in radiation therapy.

References

1. Arneson, A. N.: *Radiology* 27: 1-20, 1936.
2. Dean, Archie L.: *J. A. M. A.*, 89: 1121, 1927.
3. Everett, H. J.: *Am. J. Obst. & Gynec.*, 38: 889, 1939.
4. Cutler, Max: *Surg., Gynec. & Obst.* 74: 867, 1942.
5. Smith, George van S., and Dresser, Richard: *AM. J. OBST. & GYNEC.*, 50: 1, 1945.
6. McLennan, Charles E.: *Staff Meeting Bulletin, Hospitals of the Univ. Minnesota*, 13: No. 12, 1942.
7. Garcia, Manuel, and Schlosser, J. V.: *New Orleans M. & S. J.* 98: 314, 1946.
8. Healy, W. P., and Twombly, G. H.: *Am. J. Roentgenol.* 49: 519-530, 1943.

THE VOORHEES BAG*

An Analysis of Its Use in 164 Cases

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RECENTLY, an increasing number of competent obstetricians have gone on record as being opposed to the use of the hydrostatic bag in the conduct of labor. Williamson,¹ reporting 162 cases of placenta previa in which the hydrostatic bag was used in 51 cases, concludes that it is seldom the method of choice. Watson, in the discussion of Williamson's paper, says, "I believe the hydrostatic bag belongs to a past era in obstetrics." This is an opinion in which Cosgrove concurs. Before this Society at the January meeting, Davis criticized the use of bags in bleeding patients.

In an effort to evaluate the merits of the Voorhees bag and, if possible, to determine whether or not it has a place in modern obstetrics, this study was undertaken. The Cook County Hospital records were reviewed for a seven-year period, from 1938 to 1944, inclusive. During this time, 164 bags were used in a variety of situations. Hillis and Benensohn² state in a paper on "Fetal Mortality," that 196 hydrostatic bags were used at the Cook County Hospital in the four-year period from 1933 to 1936, inclusive. In a seven-year period, we have found only 164, so apparently the staff is making use of this method of delivery less often than formerly.

The classical indications for the use of bags as given in most obstetric textbooks are three: (1) to induce labor (usually in toxemia), (2) to prevent bleeding (placenta previa), and (3) to aid in dilatation of the cervix and prevent prolapse of the cord and small parts in abnormal presentations (transverse, breech, footlings, face, etc.).

So that an orderly presentation of the findings may be given, these 164 bag introductions have been classified according to indications. There are 64 toxemias; 82 bleeders (62 placenta previa, 20 abruptio placenta), and 18 miscellaneous indications. These are reported in three groups.

Toxemias

Twenty-two of the toxemias (Table I) had no prenatal care, and thirteen had attended a clinic on only one occasion, at which time they were sent directly into the hospital. Thirteen had made two visits for prenatal care, five had made three, and two had been to a clinic on four occasions. Two patients had been to a clinic five times, and one had been to the Cook County Hospital Clinic seven times and one ten times. These last two were the only patients in the series who may be said to have had adequate prenatal care.

The ages (Table II) ranged from 16 to 46 years, seven being from 16 to 20 years of age, twenty-nine being from 21 to 30 years of age, twenty-two from 31 to 40 years of age, and six from 41 to 46 years, inclusive.

*Read before the Chicago Gynecological Society, April 19, 1946.

TABLE I. PRENATAL CARE IN SIXTY-FOUR TOXEMIAS

NO. OF VISITS	COOK COUNTY HOSPITAL	CHICAGO BOARD OF HEALTH	CHICAGO MATERNITY CENTER	OTHERS	PRIVATE M.D.	NO RECORD	NO PRENATAL CARE
0						4	22
1	9	3		1 (Chicago Lying-In)			
2	5	2	3	1 (Reese)	2		
3	3	1	1	1 (Michael Reese)			
4	2	1					
5	1	1					
6							
7	1						
8							
9							
10	1						
Total	22	8	4	2	2	4	22

TABLE II. AGES IN SIXTY-FOUR TOXEMIAS

16 to 20 years, inclusive	7
21 to 30 years, inclusive	29
31 to 40 years, inclusive	22
41 to 46 years, inclusive	6
Total	64

The parity (Table III) ranged from para 0 to para xviii. Thirty-five patients were para iii or less, and twenty-nine were para iv or more. The question of the advisability of bags in para 0's will be analyzed later.

TABLE III. PARITY IN SIXTY-FOUR TOXEMIAS

PARITY	PATIENTS
0	9
i	9
ii	10
iii	7
iv	5
v	8
vi	3
vii	3
viii	3
ix	1
x	1
xi	2
xii	2
xviii	1
Total	64

Two patients were under 24 weeks' gestation (Table IV), nine were between 25 and 28 weeks, seventeen were between 29 and 32 weeks, and the remaining thirty-six patients were 33 weeks or more.

TABLE IV. PERIOD OF GESTATION; TOXEMIAS

WEEKS	LESS THAN 24 WEEKS	25-28	29-32	33-36	37-40	64 Total
No of patients	2	9	17	26	10	

Ten of these patients had one or more eclamptic convulsions (Table V) on admission to the hospital. Seventeen had systolic pressures of *over* 200 mm. of mercury, and a mean diastolic of 130 mm. The thirty-seven remaining patients had a mean systolic pressure of 175 mm. and a mean diastolic pressure of 116 mm.

TABLE V. TOXEMIAS

10	Eclamptics with one or more convulsion
17	Had systolic pressure of over 200 mm., and a mean diastolic of 130 mm.
37	Had a mean systolic pressure of 175 mm., and a mean diastolic of 116 mm.
64	Total

Seven of those who had convulsions (Table VI) had had no prenatal care, and only one had had adequate prenatal care, which was not effective in her case as she had an acutely fulminating type of toxemia with symptoms of only four days' duration. All were treated from one to nine days conservatively (hypertonic fluids and sedation) before a bag was used. In five, fetal heart sounds were absent on admission; of the five patients in whom fetal heart sounds were present, two were para iv, one was a para vi, one a para vii, and one a para 0.

In six patients, medical induction had failed. Seven bags were intraovular, and there were extraovular.

The first history (Table VI) is of a "failed bag." This patient was a para iv gravida v with a 24 weeks' gestation and absent fetal heart sounds. A 7 cm. extraovular bag was in place for forty-four hours without labor being established. It was then removed and the membranes were ruptured. Quinine was given to the patient and she delivered a macerated stillborn baby twelve hours later. She had a temperature of 102° F. intra partum, but recovered promptly, and went home on the ninth postpartum day.

There are three para 0's in these 10 cases of eclampsia, but it will be noted that two of them had absent fetal sounds on admission. Of the third (Case 8, Table VI), nothing can be said in favor of the management. A 19-year-old, para 0, grav. i of 36 weeks' gestation, had one convulsion before admission, and came into Cook County Hospital with good heart sounds. A nine cm. extraovular bag was placed, and, after 11 hours and 10 minutes, it was taken out. The patient was in early labor, and the cervix was 4 cm. dilated. The reason for taking the bag out is not clear. A Willet forceps was applied to the infant's scalp, and shortly thereafter, fetal sounds were not heard. The cervix was completely dilated after fifteen hours and a craniotomy done. It would seem that this patient was a good candidate for a cesarean section, and that the choice of the bag was ill advised.

In all other cases, including Case 10 in which a stillbirth resulted, delivery from below was a reasonable procedure since all were either multiparous patients or fetal sounds were absent. In the tenth case, the patient was a 31-year-old para vi, gravida vii, who had one convulsion before admission, and one after coming to the hospital. She had a viable baby and heart sounds were present. A 10 cm. intraovular bag was inserted, but labor did not start for fifteen hours, and heart sounds were lost before the bag was expelled at the end of thirty hours. A 5 lb., 7 oz. stillborn baby was delivered spontaneously.

In 39 instances, extraovular bags were used, and in 25, intraovular bags were placed. The selection of cases followed no pattern as to indications. Some members of the staff are reluctant to sanction the rupture of the membranes for fear of infection, or prolapse of the cord. Others consider that the advantage in time gained with intraovular bags justifies the risk. Our findings in this group of cases seem to bear out the latter view.

In thirty-nine patients with extraovular bags, as shown in Table VII, twelve began labor promptly, and the remaining twenty-seven established labor in from one to thirty-six hours. The average length of labor for this entire group was fifteen hours and thirty minutes. In twenty-five patients with intraovular bags, fifteen patients established labor within thirty minutes, and the remaining ten

TABLE VI. ECLAMPSIA—TEN PATIENTS

AGE (YEARS)	PARA GRAVIDA	ADMIS- SION BLOOD PRES- SURE	PRE- NATAL VISITS	CONVULSIONS BEFORE AFTER ADMISSION	PERIOD OF GESTA- TION (WEEKS)	FETAL HEART TONES AT ADMISSION	MEDICAL INDUC- TION	LENGTH LABOR	BABY	MORBID- ITY	HOME (DAY)	DIS- CHARGE BLOOD PRES- SURE
*1. 25	iv v	240 120	0	2 1	24	0	2	12 hr.	Mac. S.B.	102 I.P.	9	122 80
2. 32	iv v	250 120	0	2 0	32	+	0	10 hr. 50 min.	L.B.	0	12	150 90
3. 16	0 i	190 130	0	1 1	32	0	0	15 hr. 20 min.	S.B.	101 I.P.	10	164 90
4. 38	ix xii	218 148	0	1 0	32	0	3	18 hr. 20 min.	Mac. S.B.	0	12	120 100
5. 37	iv v	204 110	2	2 1	28	+	2	12 hr.	L.B.	0	11	No Rec.
†6. 29	vi viii	240 146	0	2 3	28	0	2	1 hr. 20 min.	Mac. S.B.	102 P.P.	8	220 100
7. 32	vii viii	230 160	0	2 1	28	+	0	3 hr. 36 min.	L.B.	0	9	130 90
†8. 19	0 i	180 140	0	1 0	36	+	2	15 hr.	S.B.	0	12	No Rec.
9. 23	0 ii	170 110	10	2 1	26	0	2	24 hr.	Mac. S.B.	101 P.P.	8	140 90
10. 31	vi vii	190 120	2	1 1	36	+	0	12 hr. 15 min.	S.B.	0	12	126 80

*Failed bag.

†Home on release.

‡Bag removed; Willet forceps to head.

TABLE VII. BAGS USED IN SIXTY-FOUR TOXEMIAS

EXTRAOVULAR BAGS			INTRAOVULAR BAGS		
NUMBER OF PATIENTS	LABOR ESTABLISHED		NUMBER OF PATIENTS	LABOR ESTABLISHED	
	HOURS	MINUTES		HOURS	MINUTES
12		30	15		30
3	1		2	1	
3	3		1	3	
2	4		3	6	
4	5		1	8	
3	7		1	14	
4	8		1	24	
2	10		1	30	
2	12				
1	15				
1	20				
1	36				
1	Failed—in place 44 hours (No. 1 on Table VI)				
Average length of labor—15 hr., 30 min.			Average length of labor—8 hr., 36 min.		

in from one to thirty hours. The average length of labor in this group was eight hours and thirty-six minutes.

There were two maternal deaths. The first was a 44-year-old para xii, gravida xiii, not prenatal, with a twenty-four weeks' gestation, and a blood pressure of 270/165. The patient came to the ward with an examining room diagnosis of uremia. Her symptoms were dizziness, blurred vision, nausea, edema, and four plus albumin was found in the urine. Fetal heart tones were present, and the uterus was one finger above the umbilicus. The urinary output on the first hospital day was 400 c.c., and by her fifth hospital day she had developed a complete anuria. A 6 cm. intraovular bag was placed. During the three-hour labor, which began promptly, the fetal heart tones were lost, and a stillborn infant, weighing one pound, was delivered spontaneously. The patient expired on her seventh hospital day. A post mortem was denied. The cause of death was considered uremia.

The second maternal death was a patient 43 years of age, para xviii, gravida xix, of about thirty-two weeks' gestation, with the membranes ruptured and a blood pressure of 170/110. She had edema and four plus albumin. Medical induction failed. This patient had previously been in the hospital for one week for painless bleeding, but on examination no placental tissue had been palpated, and, after five days of bed rest, she signed her release and went home. At that time, she had a blood pressure of 140/90. When she returned one week later, the edge of the placenta could be felt through a 3 cm. dilated cervix, and a 10 cm. intraovular bag was introduced at 6:30 P.M. on the day of admission. The blood pressure at that time was 180/112, and fetal sounds were present. At 9:30 P.M. (three hours later) the patient became cyanotic and dyspneic, and it was thought that she might be bleeding behind the bag. The bag was removed, and the bleeding found to be minimal, so a second bag was placed. The patient then had a chill, and her blood pressure dropped to 110/60, and her temperature rose to 103° F. Plasma was given and stimulants and oxygen, but in spite of these efforts, the patient continued a downhill course, and expired at 10:30 A.M., sixteen hours after the introduction of the bag, and thirteen hours after the onset of shock. Fetal heart tones were present, and a postmortem section was done, but the baby could not be resuscitated. There was a low-lying placenta, but no retroplacental blood clot and no evidence of bleeding. A post mortem was denied and the cause of death remains undetermined.

Neither of these two maternal deaths can be charged to the method of delivery. Although post mortems were denied, one was without a doubt uremia, and the other was apparently due to some sort of cardiovascular shock, or possibly to a nonconvulsive eclampsia.

In analyzing the fetal mortality (Table VIII), we find that fetal heart tones were absent before the bag was introduced in nineteen instances, and in eight instances they were lost between the introduction of the bag and delivery. Thirty-eight babies were born alive, but four of these died in the first forty-eight hours of the neonatal period. Sixty-five babies are reported, because there is one set of twins in the series.

TABLE VIII. INFANTS OF SIXTY-FOUR MOTHERS WITH TOXEMIA

Fetal heart tones absent before bag inserted	19
Fetal heart tones lost after bag inserted (intrapartum)	8
Neonatal deaths (one twin)	4
Live births (one twin)	34
Total	65

Intrapartum Fetal Deaths

There were eight intrapartum deaths, two of which were reported with the maternal deaths, and two with the eclamptics. Histories of the remaining four are as follows:

CASE 1.—B. R., aged 21 years, thirty-four weeks' gestation, para 0, gravida i, with a blood pressure of 260/170, and four plus albumin. No prenatal care. The patient had a temperature of 101° F., and the membranes had been ruptured fifty-six hours on admission. Heart sounds were present. The cervix was 3 cm. dilated, and the patient complained of mild pains, but no contractions were observed. A 9 cm. intraovular bag was placed in the cervix, and twenty hours later a stillborn infant, weighing 4 lb., 15 oz., was delivered spontaneously. The mother had a fever of 102° F. for four days. She was discharged on her fifteenth postpartum day with a blood pressure of 165/95.

CASE 2.—A. H., aged 28 years, twenty-six weeks' gestation, para 0, gravida i, with a blood pressure of 160/110. No prenatal care. This patient had hemiplegia and projectile vomiting on admission. There was a marked hematuria, and only 400 c.c. output on the first hospital day. The patient was treated medically for eight days, and on the ninth day a 8 cm. extraovular bag was introduced which was in place eighteen hours. After a five-hour labor the bag was expelled, the membranes ruptured spontaneously, and the cord prolapsed. The cervix was completely dilated, and the infant delivered promptly, but a 2 lb. stillborn infant was obtained.

CASE 3.—L. M., aged 22 years, twenty-six weeks' gestation, para i, gravida ii, with a blood pressure of 226/154, and edema and four plus albumin. Two prenatal visits. The patient had a retinal detachment on admission. Conservative treatment was used for two days, after which an 8 cm. intraovular bag was placed. The fetal heart tones disappeared after two hours, and at the end of five hours and thirty minutes, a stillborn infant, weighing 1½ lb., was delivered spontaneously. The patient signed a release and went home on her tenth postpartum day.

CASE 4.—E. C., aged 41 years, thirty-four weeks' gestation, para vii, gravida viii, with a blood pressure of 170/110, edema, blurred vision, and four plus albumin. Two prenatal visits. Two attempts at medical induction failed. On her third hospital day a 6 cm. extraovular bag was placed, and after two hours and forty-five minutes the bag was expelled. The membranes ruptured spontaneously, and the cord prolapsed. The patient was placed in Trendelenburg position, and a 10 cm. bag was introduced, but the fetal sounds were lost. After a total labor of seven hours and fifty-five minutes, a stillborn infant weighing 5 lb., 13 oz., was delivered spontaneously. The patient was afebrile, and went home on the eighth postpartum day. A larger intraovular bag should have been used.

Neonatal Deaths

Three infants in this group were less than twenty-six weeks' gestation, and died in the first forty-eight hours after birth, weighing 1 lb., 1 oz.; 1 lb., 3 oz.; and 2 lb, respectively. In each instance there was a severe maternal toxemia.

CASE 5.—L. H., aged 39 years, thirty-six weeks' gestation, para iii, gravida vi, with a blood pressure of 180/110, edema, and four plus albumin. No prenatal care. Fetal heart tones were good. Medical induction failed. On the third hospital day, a 5 cm. extraovular bag was inserted, which was expelled in four hours and fifty minutes. The pains stopped one hour after the bag was expelled, and for twenty-four hours there were no pains. A hot enema and quinine were then given, and labor promptly began, and terminated in a spontaneous delivery two and one-half hours later. The fetal heart tones were good the entire time. The membranes ruptured spontaneously just before delivery. A 6 lb., 5 oz. infant was delivered spontaneously. It had a heart beat, but breathing was not established.

This management is criticized for the delay between the expulsion of the bag and delivery. An attempt should have been made to stimulate the pains earlier. The patient was febrile for three days, and was discharged on her tenth postpartum day.

Of the nine para 0's mentioned in Table III, three have been reported with the eclampsias, two of whom had absent fetal heart sounds, and one was an ill-advised bag. Two para 0's were reported with the intrapartum infant deaths. One of these was the patient with hemoplegia and hematuria and oliguria, who had a 2-pound stillborn infant, and one had the membranes ruptured fifty-six hours on admission, and had a temperature of 101° F. One of the remaining four patients was only twenty-six weeks' gestation, and the other three patients had absent fetal sounds on admission to the hospital.

There were seven patients with intrapartum sepsis, as shown on Table IX. Five went home within ten days, one in fifteen days, and one with manual removal of the placenta was in the hospital thirty-five days. There were sixteen other postpartum morbidities, including the two maternal deaths. All of the remaining fourteen went home in twelve days or less.

TABLE IX. MATERNAL MORBIDITY IN SIXTY-FOUR TOXEMIAS

	HOME
7— <i>Intrapartum</i>	8 days
4 were reported with the eclampsias	8 days
	9 days
	10 days
1 had membranes ruptured for 56 hours on admission	15 days
1 had upper respiratory	10 days
1 retained placenta with manual removal	35 days
16— <i>Postpartum Morbidities</i> —including the two maternal deaths	
All of the remaining 14 went home in 12 days or less	
—	
23 Total patients	

Bleeders

There were sixty-two placenta previas and twenty abruptio placentas in whom bags were used. Like the toxemias, this group (Table X) had inadequate prenatal care. Forty-two had had no prenatal care, and twenty-five others had attended clinic three times or less.

The parity (Table XI) was from para 0 to para xii, with the largest number of previas falling in the para ii and para iii groups. The largest number of patients with abruptio placenta was found in the para 0 group.

TABLE X. PRENATAL CARE OF BLEEDERS

NUMBER OF VISITS	COOK COUNTY HOSPITAL	CHICAGO BOARD OF HEALTH	CHICAGO MATERNITY CENTER	OTHERS	PRIVATE M.D.	NO RECORD	NO PRE- NATAL CARE
0						1	42
1	5	2	1	1 (Chicago Lying-in)	2		
2	3	5	2		1		
3	3	1					
4	1	1					
5	1	1					
6	1						
7		1					
8	1	2		1 (Infant Welfare)			
9	1						
10	1	1					
Total	17	14	3	2	3	1	42
						Grand Total	82

TABLE XI. PARITY OF BLEEDERS

PARA	PLACENTA PREVIA	ABRUPTIO PLACENTA
0	6	5
i	3	2
ii	19	2
iii	11	2
iv	4	3
v	3	2
vi	4	0
vii	3	0
viii	1	1
ix	1	1
x	3	1
xi	1	1
xii	1	0
Total	62	20

TABLE XII. PERIOD OF GESTATION IN BLEEDERS

WEEKS	ABRUPTIO PLACENTA	PLACENTA PREVIA
24-27	3	11
28-31	5	15
32-35	9	24
36-40	3	12
Total	20	62

TABLE XIII

TYPES OF PLACENTA PREVIA	TYPES OF ABRUPTIO PLACENTA
Marginalis and lateralis	Partial separation
Partialis	Complete separation
Totals	
Total	Total
38	9
22	11
2	
62	20

TABLE XIV. PRESENTATIONS

PLACENTA PREVIA	ABRUPTIO PLACENTA
Cephalic	Cephalic
Breech	Breech
Transverse (2 with prolapsed cord and hand)	
Double footling	
Single footling	
Total	Total
44	19
11	1
4	
2	
1	
62	20

The period of gestation varied from twenty-four weeks to term. Both placenta previa and abruptio placenta occurred most frequently in the group from 32-35 weeks' gestation, and the next most frequent occurrence was in the 28-31 week group.

There were thirty-eight marginal and lateral (Table XIII) placenta previas; twenty-two patients in whom placental tissue partially covered the external os and two in which the external os was completely covered. In each of the total previas fetal sounds were absent, and both patients were multiparas. At delivery, eleven of the abruptio placentas (Table XIII) were completely separated, and nine were partially separated.

As might be expected, eleven of the placenta previa infants presented by the breech (Table XIV), four were transverse presentations, two double footlings, and one single footling. There was one instance of breech presentation among the abruptio placentas.

Ten of the abruptio placentas (50 per cent) and eleven of the placenta previas (17.7 per cent) were brought to the hospital in varying degrees of shock. Thirty of the bleeding patients received from one to four transfusions each. Seven of the placenta previas had hypertension, as did eight of the abruptios. Three other abruptios had direct trauma to the abdominal wall, which probably accounted for the retroplacental clot. In the remaining nine, the etiology is not clear.

A number of the bleeding patients were in early labor, and consequently advanced more rapidly after the introduction of the hydrostatic bag than did the toxemia group. In all cases of placenta previa, the bag was placed intra-ovularly, and the average length of labor was five hours and fifty-five minutes (Table XV), excluding the two failed bags. There were nine extraovular bags in abruptio placentas, with an average labor of seven hours and thirty minutes, and eleven intraovular bags with an average labor of five hours and forty minutes. Here again the figures show that when the intraovular bag is used the onset of labor is more prompt, and the length of labor is shorter than when the bag is extraovular.

TABLE XV. ONSET OF LABOR AFTER BAG WAS PLACED

PLACENTA PREVIA		ABRUPTIO PLACENTA			
ALL INTRAOVULAR BAGS		EXTRAOVULAR		INTRAOVULAR	
PATIENTS	TIME OF LABOR	PATIENTS	TIME	PATIENTS	TIME
34	Within 30 min.	7	within 30 min.	6	within 30 min.
10	Within 1 hr.	1	within 1 hr.	2	within 1 hr.
4	Within 2 hr.	1	within 4 hr.	2	within 2 hr.
2	Within 3 hr.			1	within 4 hr.
4	Within 4 hr.				
1	Within 6 hr.				
2	Within 7 hr.				
1	Within 9 hr.				
1	Within 11 hr.	<i>Average Length of Labor</i>			
1	Within 18 hr.	Intraovular—Placenta previa		5 hr. 55 min.	
2	Failed	Intraovular—Abruptio placenta		5 hr. 40 min.	
		Extraovular—Abruptio placenta		7 hr. 30 min.	

There were two failed bags among the placenta previas:

CASE 1.—Aged 33 years, para vi, gravida vii, Mexican. No prenatal care. The patient came to Cook County Hospital one month before term with a history of vaginal bleeding for two hours. Sterile vaginal examination revealed a marginal placenta previa. Her pulse was 110, blood pressure 115/65, and membranes intact. Fetal heart tones were 140. The membranes were ruptured artificially, and an intraovular 11 cm. bag was introduced. Quinine and pituitrin failed to produce labor. After twenty hours, the patient developed a temperature of 102° F., and after thirty-six hours the bag was removed. Fetal

sounds were present, and the position was transverse. Twelve hours later the cervix was completely dilated, but fetal heart tones could no longer be heard. Forty-eight hours after the bag was first introduced and twelve hours after it was removed, a female stillborn infant, weighing 5 lb., 15 oz., was extracted by the breech. The patient ran a fever for three days, but went home on her eighth postpartum day.

CASE 2.—Aged 33 years, para vi, gravida viii, was admitted to Cook County Hospital with ruptured membranes and a prolapsed cord. The cord was replaced, and a 10 cm. bag introduced. This failed to produce labor after forty-seven hours, and because fetal sounds were still present, a Porro section was done, but a 7-pound stillborn infant was delivered. The patient ran a septic course for three days, but was able to go home on her fifteenth postpartum day.

Fetal heart tones were absent on admission (Table XVI) in sixteen (25.8 per cent) patients with placenta previa, and in fifteen patients (75 per cent) with abruptio placenta. There were nine intrapartum deaths, ten neonatal deaths, with a total salvage of thirty-five infants. There were three sets of twins, and consequently eighty-five infants are reported.

TABLE XVI. FETAL OUTCOME IN EIGHTY-TWO MATERNAL BLEEDERS

	PLACENTA PREVIA	ABRUPTIO PLACENTA
Fetal heart tones absent on admission	16	15
Intrapartum deaths	8	1 (Twin, 1 lb., 3 oz.)
Neonatal deaths	9	1 (Twin, 1 lb., 2 oz.)
Live births	31	4
Total	64 (2 sets of twins)	21 (1 set of twins)

Of the eight intrapartum (Table XVII) fetal deaths, two have been reported with the failed bags. One set of twins and three single infants weighed 2 pounds or less. There is also an eight months' gestation in this group that had ruptured membranes for one week before admission, and had a temperature of 101° F. The infant's heart tones were lost one hour and twenty minutes after the bag was introduced, and a 4 lb., 4 oz. stillborn infant was delivered.

TABLE XVII. PLACENTA PREVIA FETAL MORTALITY; EIGHT INTRAPARTUM DEATHS

2	were reported with failed bags.
2	Seven month twins. Membranes ruptured forty-eight hours on entrance. First baby breech. Fetal heart tones lost one hour after bag. Weight, 1 lb., 6 oz. and 1 lb., 3 oz. Total labor five hours.
1	Seven months' gestation. Cord and arm prolapsed on entrance. Weight, 2 lb.
1	Six and one-half months' gestation. Membranes ruptured sixty hours on entrance. Weight, 1 lb., 10 oz.
1	Six and one-half months' gestation. Weight, 1 lb., 7 oz.
1	Eight months' gestation. Membranes ruptured one week before admission. Temp. 101° F. Fetal heart tones disappeared one hour and twenty minutes after bag was introduced. Weight, 4 lb., 4 oz.

TABLE XVIII. NINE NEONATAL DEATHS IN PLACENTA PREVIA

1.	6 months	Weight, 1 lb. Lived 1 hour.
2.	6 months	Weight, 1 lb., 4 oz. Lived 36 hours.
3.	6½ months	Weight, 1 lb., 2 oz. Lived 12 hours.
4.	6½ months	Patient bled three weeks at home—shock. Weight, 1 lb., 3 oz. Lived 3 days.
5.	7 months	Weight, 1 lb., 12 oz. Spontaneous breech. Lived 2 hours.
6.	7 months	Weight, 1 lb., 15 oz. Spontaneous. Lived 24 hours.
7.	7 months	4 lb. Transverse. Version and Extraction. Lived 40 min.
8.	7½ months	Weight, 3 lb., 12 oz. Breech extraction—foot and cord prolapsed when bag was expelled. Lived three days.
9.	7½ months	Weight, 2 lb., 3 oz. Spontaneous. Lived 36 hours.

There were nine neonatal deaths in the placenta previas, of which six were less than two pounds in weight, and the period of gestation in four of these was twenty-six weeks or less (Table XVIII).

There were twenty patients with morbidity, of which nine were intrapartum and eleven postpartum fevers. None of these were seriously ill, and the average hospital stay for the septic group was eleven days, while the average for the afebrile group was nine days (Table XIX).

TABLE XIX. MATERNAL MORBIDITY IN EIGHTY-TWO BLEEDERS

<i>Intrapartum</i> —9 patients	
2	Failed bags
2	With nonsterile gauze pack in vagina on entrance
2	Upper respiratory infections
1	Pyelitis
2	Membranes ruptured on admission for more than thirty hours
<i>Postpartum</i> —11 patients	
Total—20 patients	
Average length hospital stay in the morbidities was 11 days.	
Average for the afebrile patients in this group was 9 days.	

Miscellaneous

There were eighteen bags placed for a variety of reasons, and they have been grouped under the heading miscellaneous. Nine of these (Table XX) were used in transverse presentations, two in deflexion attitudes, one with a compound presentation, one double footling with a prolapsed cord, one a single breech with a forelying cord, two cephalics with forelying cords, one ruptured membranes for four days on admission, and one para vi at eight months with a diaphragmatic hernia. This latter patient was dyspneic and had become emaciated from inability to retain food because of mechanical pressure.

TABLE XX. EIGHTEEN MISCELLANEOUS PATIENTS

9	Transverse presentations	2	with arm and cord prolapsed
		2	with arm prolapsed
		1	with membranes ruptured and no pains
2	Face presentations		
1	Compound presentation—head and hand		
1	Double footling with cord prolapsed		
1	Single breech with forelying cord		
2	Cephalics—1 with occult cord; 1 with prolapsed cord		
1	Ruptured membranes 4 days with no pain		
1	Diaphragmatic hernia		
18 Total			

TABLE XXI. FETAL MORTALITY IN MISCELLANEOUS

1	Fetal heart tones absent on admission. Double footling with cord prolapsed.
2	Intrapartum deaths.
	Para iii, gravida iv, with arm and cord prolapsed
	Para iv, gravida v, with arm and cord prolapsed
	Both delivered via version and extraction
	Both were eight months' pregnant
1	Arm prolapsed to elbow. In labor on admission.
	Delivered by version and extraction ten hours and fifty minutes after bag inserted
	Gestation of seven months. Weight, 3 lb., 4 oz.
	Expired 56 hours after birth
4 Total	

There were four fetal deaths in this group (Table XXI)—on antepartum, two intrapartum, and one neonatal. All of the three stillbirths had prolapsed cords on admission. In the neonatal death, the patient entered the hospital with an arm prolapsed to the elbow. This was a seven months' gestation, and was delivered by version and extraction 10 hours, and 50 minutes after the bag was introduced. The infant weighed 3 pounds, 4 ounces and expired fifty-six hours after birth.

The morbidity for the miscellaneous group was eight cases. Two of these morbidities were intrapartum and six postpartum. The average hospital stay was nine and one-half days.

Summary

One hundred and sixty-four patients are reported in whom a hydrostatic bag was used. There were four sets of twins and hence one hundred and sixty-eight babies. The gross infant mortality was eighty-five. In fifty-one patients fetal heart tones were absent when the patients were admitted to the hospital. There were thirty-four stillbirths and neonatal deaths, of which sixteen were twenty-six weeks or less in gestation, and the infants two pounds or less in weight. The corrected infant mortality is eighteen or ten and seven-tenths per cent (Table XXII).

TABLE XXII. SUMMARY

164 patients in whom a hydrostatic bag was used.
168 infants (four sets of twins)
85 gross infant mortality
51 babies were dead on admission
34 stillbirths and neonatal deaths
16 were twenty-six weeks' or less gestation and two pounds or under in weight
18 corrected infant mortality, or 10.7 per cent

In the group of patients reported here, a large percentage of patients were not good risks for abdominal delivery for one reason or another. It is considered good obstetric practice to deliver patients from below in all instances where the infant viability is questionable. A mother should not be subjected to the risk of major abdominal surgery in the interest of a baby whose chances of survival are already minimal. This error was made in the case of the Porro section following a failed bag, and a stillbirth resulted.

In the seven-year period which this investigation covers, approximately 28,000 babies were delivered at the Cook County Hospital. Only one hundred and sixty-four bags were used, which is a very small percentage of the total. In some of the cases reported the choice of the hydrostatic bag was not wise, and in others too small a bag was used. However, a situation poorly selected for a given procedure, or one which is mismanaged, should not condemn the method used.

The method of delivery is influenced by the duration of the pregnancy, the parity of the patient, and the condition of both mother and baby. When one elects to introduce a hydrostatic bag, there is already an obstetric difficulty. The patients on whom bags were used, for the most part, are patients who were in no condition for abdominal surgery, or in whom the baby was dead or previsible. It is not, therefore, reasonable to compare the results of bags with the results of cesarean section.

It would seem that the hydrostatic bag still has a limited place in the obstetric armamentarium, but no fixed policies can ever apply to its use. Careful consideration of each situation and good obstetric judgment are essential if the best interests of both mother and child are to be served.

References

1. Williamson, A. C., and Greeley, A. V.: *AM. J. OBST. & GYNEC.* 50: 398, 1945.
2. Hillis, David S., and Benensohn, S. J.: *AM. J. OBST. & GYNEC.* 36: 427, 1938.

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Discussion

DR. ROBERT M. GRIER.—At the January meeting of this Society, Dr. M. E. Davis reported the results of the treatment of placenta previa at the Chicago Lying-in Hospital. In this report he more or less condemned the use of the hydrostatic bag for this condition. His arguments were quite convincing. I must admit that my experiences with it have given me many headaches. It does not work as well as Nature, but neither does any man-made effort. It is an artificial attempt to handle an abnormality, and does have a definite place in our armamentarium.

When one studies the situations described in this series of cases at the Cook County Hospital in seven years, it is obvious that they have had to deal with more extreme problems than most of us will see in private practice in a lifetime. I do not think the Lying-in Hospital has the ignorance and shiftlessness to deal with in their patients which is true of the Cook County Hospital.

Some of the women with toxemia who were delivered after induction of labor with a bag might well have been delivered better by cesarean section. It seems to me that if the toxemia is severe enough to warrant prompt delivery, a cesarean section done under local anesthesia is a quicker and more certain way of terminating the pregnancy. The time expended in establishing labor in addition to labor itself, may be time enough for eclampsia to develop. When the toxemia is progressing in this direction in spite of conservative management, the only thing we can do for these women is to deliver them as soon as possible. I have very little confidence in our ability to abort eclampsia in any other way. It appears much better to get rid of the cause which apparently is an incompatibility between mother and fetus.

This does not mean that either cesarean section or the hydrostatic bag should be used when a woman is in the eclamptic state. The pregnancy here must be disregarded while an attempt is made to temporarily reduce the toxemia. It is difficult to decide when this has been accomplished. If it has, then it is only temporary, and a cesarean section under local anesthesia is the more efficient method of delivery.

The author has stated that another indication for the bag is placenta previa and abruptio placenta. In the latter condition I think cesarean section is safer because we are dealing with concealed hemorrhage. No time should be wasted with bag induction. In the former it is often too late to attempt cesarean section and the Voorhees bag has a definite place. It can usually be employed to control hemorrhage quicker than an operating room can be prepared and this is life saving time. It will be more often successful in getting a live baby than will Braxton-Hicks version. In this procedure one elects to use the baby as a tampon regardless of the danger to the child. Away from hospital facilities it may be a life saving procedure. If the viability of the baby is questionable anyway, it is justified.

When one is dealing with placenta previa and a baby that is near term, and there is time to prepare for the cesarean operation, and we are sure of our diagnosis, be it only a low-lying placenta, I think this is the safest procedure for both mother and baby. Especially is this true when the cervix is uneffaced and undilated, be it in a primipara or multipara. I believe it is better to do too many cesarean sections under these circumstances than too few.

At the Evanston Hospital in over 10,000 deliveries we have inserted the Voorhees bag only 23 times. One mother was lost in this procedure. This was a case of gross neglect on the part of an inexperienced man who failed to have consultation until it was too late.

Our indications were as follows:

Placenta previa	15
Abruptio placenta	1
Toxemia	3
Prolapsed cord	2
Pyelitis	1
Failure of medical induction after premature rupture of membranes—7 days	1
Fetal salvage	11
Neonatal deaths	5
Intrapartum deaths	5
Antepartum deaths	2
<i>Period of Gestation</i>	
26-40 weeks	12
31-35 weeks	4
26-30 weeks	4
21-25 weeks	1
Under 20 weeks	2
Multiparas	14
Primiparas	9

DR. G. C. RICHARDSON.—Dr. Webster, in her opening statement, differed with the widespread and extreme condemnation of the bag as presented in the recent literature. Too frequently when one starts out to study a series of cases in this manner, they are apt to be prejudiced in that study. This has seemed quite the opposite in Dr. Webster's case, for she has taken the case histories of the Cook County service and has taken the cases that were operated upon or delivered by those with whom she is associated and in a number of instances has even criticized the choice of the use of the bag.

In preparing to discuss this paper, with the extreme trend of the literature, I felt it might be in keeping with the nature of the paper to review the textbooks on obstetrics and to get an expression as put forth by them. I went over the outstanding textbooks on obstetrics and reviewed their indications for the use of the bag. All expressed the opinion that there was a place for the bag. In one text only was there an expression or intimation that the bag should be completely discontinued in obstetric practice. In studying the opinions set forth in these various textbooks, the indications for the use of the bag numbered some twenty odd, all of which could be included under Dr. Webster's brief classification of the three indications. As to the actual use of the bag there are certain conditions that must be met. There must be some dilatation of the cervix for its introduction or a means of dilating the cervix with the least injury to the tissues involved. Some of the conditions expressed were that you must have a living baby. To that I take exception.

Dr. Webster has by the nature of this study not been able to cover every phase of the use of the bag in obstetrics. It is not possible in such a discussion, to completely cover all the uses of the bag. In the use of the bag in placenta previa and eclampsia we have a wide variation of conditions that must be met: the location of the placenta in placenta previa, the degree of hemorrhage, whether or not we have an outlook for securing a living baby, and last but not least, the time factor. One of the great things that we must consider in the use of the bag is whether the woman can be delivered in appropriate time by the introduction of the bag either to secure dilatation or to induce labor or to facilitate labor that is already in progress. In eclampsia the time element enters again. If we start with the bag and the condition becomes more serious, then having started we are not able to change our course and thus are not able to employ a means that would give a satisfactory result. In saying this I am not criticizing the use of the bag in eclampsia but there are certain cases of eclampsia or uremia where the bag will fail as a result of the edematous type of cervix. In others there is a place for the bag provided the patient is not in condition where the time element requires more rapid delivery than we can expect by the introduction of the bag. In those cases we have to be very careful in the selection of the case. There are various other conditions. We must not have cephalopelvic disproportion whereby after securing adequate dilatation and stimulating labor by the use of the bag, we are still unable to deliver the baby through the pelvis. Some of the errors in the use of the bag are less serious today than they were

some years ago inasmuch as we have the sulfonamides to combat infection and penicillin to use for the same purpose.

There are also contraindications. One is the possibility of infection, another is the dislodgment of the presenting part and the possibility of producing a prolapse of the cord. It seems quite obvious that Dr. Webster has given this very serious thought. She has presented cases with a bad outcome and those with good results. It would seem that her case in defense of the bag certainly is worthy in selected cases. The criticism of its use in some of these cases indicates to me that her idea is to be very selective in the cases in which she pursues this course to termination of labor.

DR. W. C. DANFORTH.—I feel, as the essayist said, that in a certain percentage of placenta previas, particularly if the viability of the child is in question and also if we are dealing with a multipara, that the use of the bag still has a definite place. I do not believe we should completely do away with it, though the frequency of its use is definitely less than it was.

DR. EDWARD L. CORNELL.—During the years 1917 to about 1927, when I was associated at the Lying-in Hospital with Dr. DeLee, we used the bag frequently. At that time he wanted some means of determining how much dilatation we had with the use of the bag and set me to work on it. I developed the ring bag, as some of you know. We used the bag at that time in atresia and placenta previas and in multiparas in which we wanted to induce labor, and, in fact, we more or less generally used it. Our results for the period of time of the study were such that Dr. DeLee decided that the bag was being used altogether too much. We developed a technique there which, I think, if we are going to use the bag, perhaps it would be helpful.

If the cervix is long and not dilated in a multipara and you put in a 10 cm. bag, the bag floats up above the cervix because it is impossible for the stem of the bag to fit in. The head is displaced and pushes the bag over to the side so that you have two objects there instead of one attempting to dilate the cervix. The reason we have so many different size bags is for this purpose. One should start with the smallest bag possible, 4 or 5 cm. bag, which is more apt to fit in properly. The head being down, the bag will not displace it to the same degree as the large bag. After the 4 or 5 cm. bag has been expelled, then a larger bag is inserted. This is the technique that should be followed in a primipara. If, on the other hand, the cervix is dilated and more or less fixed, a large size bag can be placed, the stem will be down in the cervix and the head cannot get in between the wall of the uterus and the bag.

If you wish to keep that bag in position, you must put a weight on it. We put on anywhere from a one-half to a two and one-half pound weight attached over a traction pulley to the end of the bed, thus having that weight constant all the time. This is apt to put the patient into labor much sooner.

As I said, we came to the conclusion that the bag was being used altogether too often, so that we used it chiefly after 1927 in eclamptics and in multiparas in whom we wished to induce labor for various reasons. At that time we used to think we should induce labor if the patients went over term for two weeks or more.

Gradually, I have discontinued the use of the bag. I do not use it in placenta previa or in atresia; in fact, I have not used a bag in private practice in the last seven or eight years.

DR. WEBSTER (Closing).—Dr. Richardson's point regarding conditions must be considered in each individual instance. There are certain conditions of the cervix which would not permit the introduction of the bag.

In reply to Dr. Cornell regarding weights; weights are used quite often in toxemias, but we have been a little fearful of the use of weights when there is a low-lying placenta. Dr. Hillis used to insist that the resident stay with the patient who had a low-lying placenta and exert just enough digital pressure on the stem of the bag to control the bleeding. He feared that a weight of one or two pounds would start a tear in the cervix that could not be controlled.

AN ANALYTICAL SURVEY OF ECLAMPSIA

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THIS survey is concerned with a careful attempt to analyze a group of pregnancies complicated by eclampsia, consisting of 62 cases which were treated in the Division of Obstetrics from January, 1927, to December, 1945. Although studies and surveys have been reported in the literature from time to time, we feel that additional data and studies of eclampsia will act to emphasize certain factors of diagnostic and prophylactic importance.

In this study, it was attempted to correlate our findings with possible relationships to age, race, parity, signs and symptoms, seasonal variations, and type of delivery.

From Jan. 1, 1927, to Dec. 31, 1945, there were delivered 14,374 ward patients, and in this group there occurred 62 cases of eclampsia, for a percentage of 0.43, or one eclamptic in 231.8 delivered cases.

In the first five years, from 1927 to 1931 inclusive, there were delivered 3,223 cases, and in this group there occurred 20 cases of eclampsia or 0.62 per cent (1 in 161.1 cases). While during the last five years from 1941 to 1945, inclusive, there were delivered 4,233 cases, and in this group there occurred 17 cases of eclampsia, or 0.4 per cent (1 in 248.4 cases). From these figures it will be noted that the frequency of eclampsia is decreasing (Fig. 1).

The age at which eclampsia occurs is of considerable interest to the student of this complication. The youngest patient in our survey was 15 years old, the oldest being 44 years. Hinselmann found that 90 per cent of all patients with eclampsia are between the ages of 14 and 30 years.

Fig. 2 illustrates the occurrence of eclampsia according to age.

It can be observed that 83.8 per cent occurred between the ages of 15 and 30 years, 69.3 per cent occurred between the ages of 15 and 25 years, and 46.7 per cent occurred between the ages of 15 and 20 years. From these observations it may be noted that practically half of our cases occurred between the ages of 15 and 20 years.

In this series, eclampsia occurred in primiparas 41 times and in multiparas 21 times, an approximate ratio of primiparas to multiparas of 2 to 1. It was found that 66.1 per cent of the eclamptics were primiparas. Other observers have found a ratio of 6 to 1 when comparing the frequency of eclampsia in primiparas and multiparas. Some others have given figures of approximately 80 per cent of eclampsia occurring in primiparas (Fig. 3).

Racial Incidence of Eclampsia (White and Negro).—It was found that 56.4 per cent of the eclamptics were Negroes, and 43.5 per cent were white.

Attempts have been made to determine the part played by seasonal variation in eclampsia, and also the effects of abrupt changes in barometric pressure. We have attempted to note that frequency of eclampsia in the various months, and also during the different seasons. The most cases occurred in June, for a total of almost 16.1 per cent of all cases in our series.

According to seasons, the frequency of occurrence was as follows: summer, 33.8 per cent; autumn, 22.5 per cent; winter, 25.8 per cent; spring, 17.7 per cent.

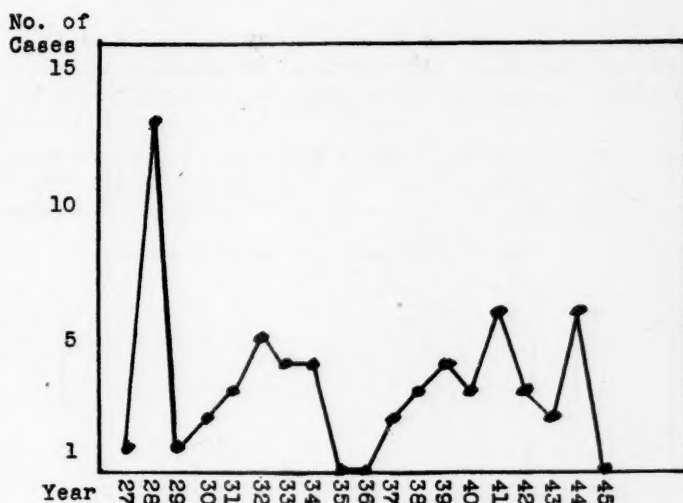


Fig. 1.—Number of cases of eclampsia occurring from Jan. 1, 1927, to Dec. 31, 1945, by years.

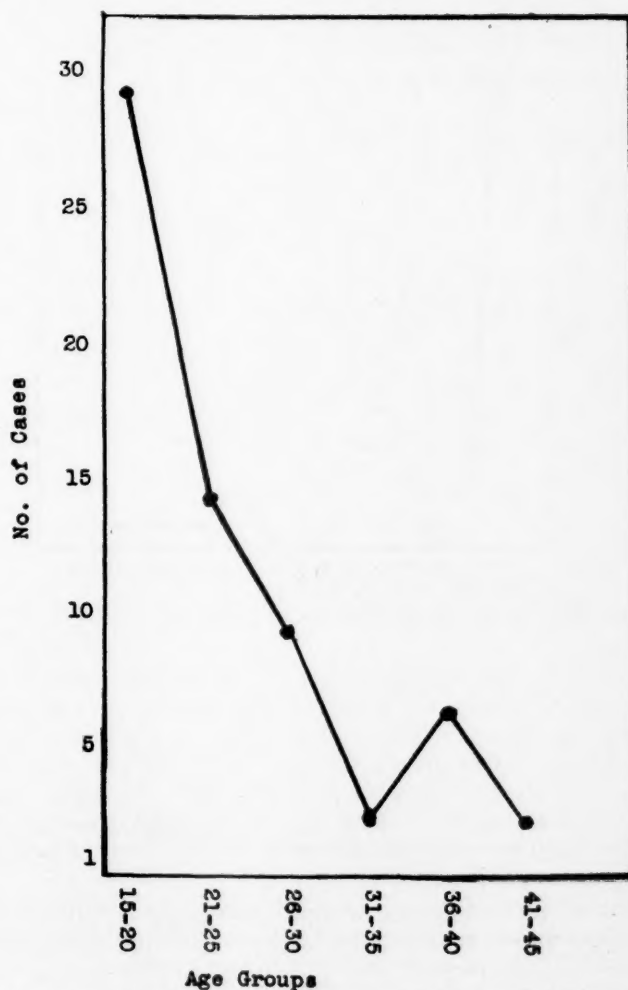


Fig. 2.—Number of cases of eclampsia occurring in various age groups. Youngest patient—15 years. Oldest patient—44 years.

Fig. 4 shows the frequency of eclampsia occurring during the various months and also the mortality incidence. It is not apparent whether the frequency of eclampsia during a certain month of the year bears any relationship to mortality.

It is of interest to note the relative frequency of the various premonitory signs and symptoms of eclampsia. Table I illustrates the frequency of the various signs and symptoms as they occurred in our group of eclamptic patients.

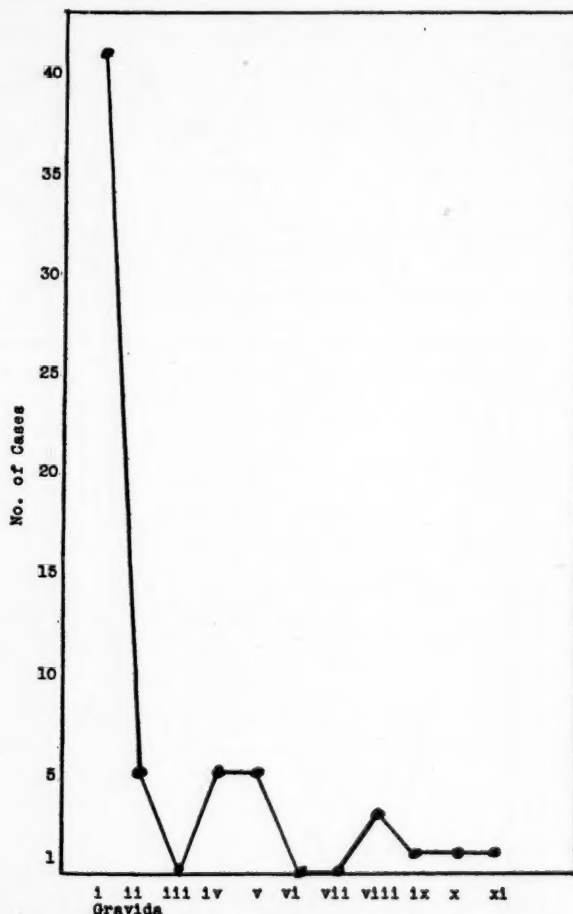


Fig. 3.—The frequency of eclampsia in primiparas and multiparas.

It may be noted that hypertension, edema, edema associated with rapid gain in weight, and albuminuria occurred in 100 per cent of these cases.

In reviewing the blood pressure estimation of our cases, we find that the highest recorded blood pressure was 290 systolic, and the lowest systolic blood pressure recorded in this group of eclamptics was 140. The highest diastolic blood pressure was 200, and the lowest 70. Strange as it may seem, the patient with the systolic blood pressure of 290 and the one with diastolic blood pressure of 200 made a good recovery.

The patients in this summary were classified according to the time that eclamptic seizure occurred, that is, ante partum, intra partum, and post partum. Table II illustrates the number of patients in each group.

TABLE I. SYMPTOMS AND SIGNS

Hypertension	62
Edema and rapid weight gain	62
Edema	35
Rapid weight gain	27
Albuminuria	62
Eye symptoms	25
Nervous manifestations	10
Headache	43
Dizziness	14
Insomnia	4
Gastrointestinal	
Nausea	8
Heartburn	9
Vomiting	14
Pain	
Substernal	19
Epigastric	8
Dyspnea	8
Palpitation	7
Dysuria	3
Hematuria	1

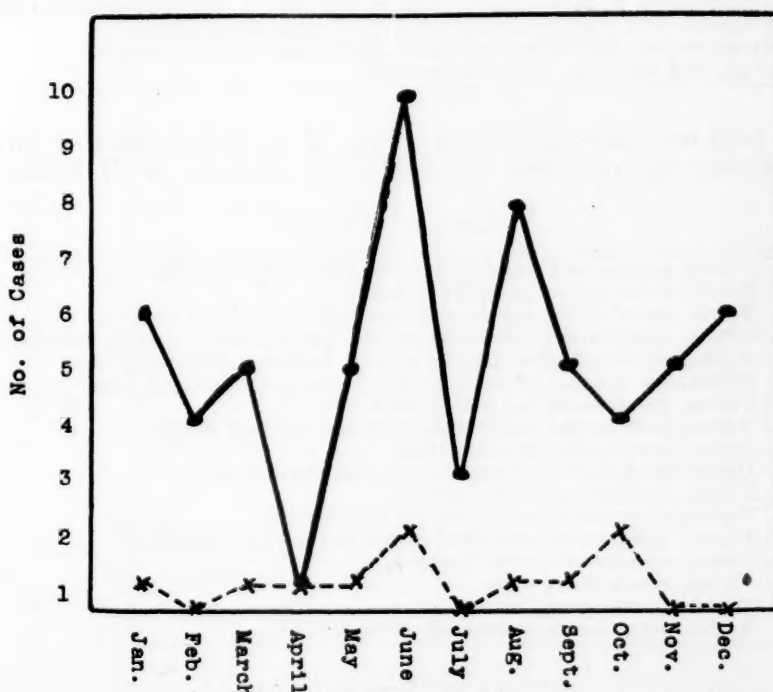


Fig. 4.—The frequency of eclampsia during the various months and the mortality during these months.

Arnell in his series found the following: ante partum, 52.1 per cent; intra partum, 21.1 per cent; post partum, 26.8 per cent.

Of the 62 eclamptic patients, 55 of them were delivered of 58 babies, there being three sets of twins. Six patients died undelivered, and one patient signed a release and was delivered elsewhere.

It is to be noted that four babies were born alive and died following delivery. The periods of survival ranged from eleven hours to six days (Table IV).

TABLE II

Ante partum	45	72.5 per cent
Intra partum	11	17.7 per cent
Post partum	6	9.6 per cent

TABLE III

Patients	62	(Eclampsics)
Patients undelivered	7	(Six died undelivered, and one signed release after recovery and was delivered elsewhere)
Patients delivered	55	(Three sets of twins)
Babies born		
Alive	41	
Stillborn	17	
Total	58	(Including three sets of twins)

TABLE IV. BABIES DIED FOLLOWING DELIVERY

1. Spontaneous delivery, died in eleven hours, vertex, premature (seven months), showed evidence of birth injury, tentorial tear and 4 plus Wassermann (mother)
2. Low forceps died in fifteen hours, vertex, full term (one of twins)
3. Cesarean section, died third day, eight and one-half months, toxemia
4. Forceps, died sixth day, full term, toxemia

The fetal mortality was 37.7 per cent. If we include the four infants who died following delivery, then the total fetal mortality is 27 babies, or 44.2 per cent.

TABLE V. STILLBORN

1. Vertex, spontaneous, macerated, seven and one-half months
2. Breech, second of twins, stillborn, term
3. Vertex, one of twins, spontaneous, cerebral hemorrhage, term
4. Vertex, spontaneous, hemorrhage into parenchymous organs, atelectasis
5. Vertex, version, internal podalic version, subdural hemorrhage, term
6. Vertex, low forceps, hemorrhage into parenchymous organs, term
7. Vertex, spontaneous, macerated, term
8. Vertex, spontaneous, macerated, seven and one-half months
9. Vertex, low forceps, stillborn term
10. Hysterotomy, eight and one-half months, sterilization
11. Vertex, spontaneous, seven months
12. Vertex, spontaneous, seven and one-half months
13. Breech, spontaneous, macerated, seven and one-half months
14. Breech, spontaneous, seven months
15. Vertex, spontaneous, term
16. Vertex, spontaneous, term
17. Vertex, spontaneous, macerated, seven months

TABLE VI. TYPE OF DELIVERY

Spontaneous	33
Forceps	15
Breech	4
Cesarean section	4
Internal podalic version	2
	58 deliveries
(All four cesarean sections were performed on patients after recovery from eclampsia)	
(Six undelivered infants, 58 plus 6 = 64 infants for 61 patients. One patient signed release after recovering from eclampsia and delivered elsewhere)	

TABLE VII. ANALYSIS OF ECLAMPTIC PATIENTS WHO DIED

AGE (YR.)	RACE	GRAV- IDA	GESTA- TION (MO.)	PRE- NATAL CARE	NO. CONVUL- SIONS	SIGNS AND SYMPTOMS	TYPE DELIVERY	BABY	REMARKS
38	Negro	xi	6½	None	3	Convulsion, coma. BP 240/148; plus 4 alb.; NPN. 24; CO ₂ 44.8	Not delivered	Not delivered	Coma, died undelivered four and one-half hours after admission
16	Negro	i	7	Insufficient	?	Premature separation placenta. BP 156/110; plus 4 alb. Intrapartum eclampsia, died 9 days later from sepsis	Spontaneous	Stillborn, 4½ lb. macerated	Intrapartum eclampsia
30	Negro	i	9	Insufficient	1	Convulsion, coma. BP 200/150; plus 4 alb.; NPN. 28; uric acid 9.88; CO ₂ 37.2; eye grounds normal	Spontaneous	Stillborn	Sudden death (cardiac) fifth day
17	Negro	i	9	Insufficient		Convulsions. BP 150/100; plus 2 alb.; bl. sug. 82; NPN. 30.6; creatinin 1.4; uric acid 6.9; CO ₂ 56.64	Post mortem	Dead	Died five hours after admission
27	Negro	v	9	Insufficient	3	Convulsions, coma. BP 220/180; plus 3 lb.; NPN. 28; uric acid 5.32; protein 6.36; alb. 3.88; globulin 2.48; bl. sug. 75	Post mortem	Dead	Died fourteen hours after admission
38	White	v	7	Insufficient	3	Convulsions, coma, anuria. BP 150/110; bl. sug. 108; NPN. 55.5; urea 30.61; creatinin 2.22	None	Not delivered	Died six hours after admission
32	Negro	viii	9	Insufficient	5	Second day postpartum convulsion. BP 240/100; bl. sug. 130; NPN. 30.44.	Spontaneous	Living	Died ten hours after admission
22	White	i	9	None	8	Convulsions. BP 226/140; plus 3 alb.; hyaline and gran. casts; bl. sug. 122; NPN. 37.72; creatinin 1.72; uric acid 5.5	Induction of labor internal podalic version and traction	Stillborn	
39	White	i	7	None	Many	Convulsions. BP 245/?	Postmortem cesarean section	Dead	Died a few minutes after admission
28	White	i	7	None	Many	Convulsions, coma. BP 184/124; plus 4 alb.; hyaline and gran. casts; bl. sug. 75; NPN. 34.08; blood urea 16.51; creatinin 1.43; uric acid 5.7; CO ₂ 45.05; eye grounds hemorrhagic retinitis	Not delivered	Not delivered	Died twenty hours after admission, pulmonary edema

The patients in this survey were delivered as shown in Table VI.

From Table VIII it may be observed that maternal mortality in this series was 16.1 per cent. Five cases, or 50 per cent of our fatalities from eclampsia occurred during the year 1928. Since 1942 there has not occurred a fatality from eclampsia, and, what is more, in 1945 there did not occur a single case of eclampsia, although the reduction does not hold for the total number of toxemias.

TABLE VIII. YEARS OF OCCURRENCE OF MATERNAL MORTALITY

1928	5 deaths
1932	1 death
1938	1 death
1939	1 death
1941	1 death
1942	1 death
	10
No deaths since 1942	

The factor responsible for the decrease in the incidence of eclampsia is the early detection of and institution immediately of proper treatment for pre-eclampsia, and the education of the public to the importance of prenatal care.

It may be observed that all the fatal cases were without adequate prenatal care. With the advent of improved prenatal care it can be observed how important prenatal care is to the pregnant woman.

In this series of 62 eclamptic patients, 48 patients had inadequate prenatal care and 14 patients were classed as having no prenatal care at all. From these figures one need not ponder very much as to the important factor in preventing this dangerous and often fatal complication in the pregnant and delivered patient.

TABLE IX. PRENATAL CARE, ITS RELATION TO MORTALITY AND ECLAMPSIA

CARE	NO. CASES	MORTALITY
Inadequate	48	6 or 12.7 per cent (1 in 8)
None	14	4 or 28.5 per cent (1 in 3.5)

It will be noted that the mortality is more than twice as great in the patients who did not receive prenatal care at all as compared with those patients who received inadequate prenatal care. For example, it may be observed in Table IX that the maternal mortality in the eclamptic series was 1 in 8 patients for those who received inadequate prenatal care, and rose to the appalling figure of 1 in 3.5 patients, who received no prenatal care whatsoever.

In this series of 62 cases of eclampsia we have selected two cases of interest.

Case Reports

CASE 1.—A young Negro woman, 16 years old, gravida i, 8 months' gestation, with inadequate prenatal care, was admitted to the hospital with a blood pressure of 160/80, in convulsions. Treatment was instituted. She improved and recovered from the eclamptic attack, remaining in the hospital for ten days. She then signed a release against the advice of the staff. One month later she was again admitted with convulsions, in eclampsia with a blood pressure of 150/100. This time she had approximately 18 convulsions, 11 during the time she was in the delivery room. She was delivered of a living infant, and, eight days later, after recovery, signed a release and left the hospital. Both mother and infant apparently were in good condition.

CASE 2.—This patient had eclampsia with her first pregnancy, and was delivered of a stillborn child five years before this pregnancy.

She was a white, 23-year-old pregnant woman, with inadequate prenatal care, admitted to the hospital in active labor. Convulsions occurred during labor, with blood pressure of 166/84. This patient was delivered of a living infant weighing 9 pounds, 10 ounces, and mother and child left the hospital in good condition.

Summary

1. This survey included a series of 62 cases of eclampsia which occurred from January, 1927, to December, 1945. During that period, 14,374 cases were delivered, the percentage of eclamptic patients being 0.43 per cent, or 1 eclamptic in 231.8 delivered patients.

2. There occurred in the first five years, 1927 to 1931 inclusive, 20 cases of eclampsia in 3,223 delivered patients for a percentage of 0.62, while the number of eclamptics for the last five years, 1941 to 1945, inclusive were 17 in 4,223 delivered patients, for a percentage of 0.40. In the first five years the frequency was one eclamptic in 161.1 delivered cases, while in the last five years there occurred 1 eclamptic case in 248.4 delivered cases, showing a decrease.

3. Practically half of our cases of eclampsia occurred between the ages of 15 and 20 years (46.7 per cent).

4. The occurrence of eclampsia in primiparas and multiparas was approximately 2 to 1.

5. The frequency with which eclampsia occurred during the various seasons are as follows: summer, 33.8 per cent; winter 25.8 per cent; autumn, 22.5 per cent; spring, 17.7 per cent.

6. All of our patients showed the following: hypertension, edema, and albuminuria.

7. Eclampsia occurred as follows: ante partum, 72.5 per cent; intra partum, 17.7 per cent; post partum, 9.6 per cent.

8. The fetal mortality was 37.7 per cent. If we included four infants who died between eleven hours and six days following delivery, the fetal mortality would rise to 44.2 per cent.

9. In this series of 62 cases of eclampsia there were 10 maternal deaths for a maternal mortality of 16.1 per cent.

It should be noted that the mortality was over two and one-fourth times as great in the patients who have had no prenatal care as compared with those who had inadequate prenatal care.

Conclusions

This study merely substantiates the conclusions arrived at from other similar studies that prophylaxis, education and adequate prenatal care is the answer to the control and prevention of eclampsia.

References

1. Dieckmann, W. J., and Brown, I.: *AM. J. OBST. & GYNEC.* 37: 762, 1939.
2. Adair, Fred L.: *Textbook of Obst. and Gynec.*, vol. I, Lea and Febiger, Philadelphia.
3. Mussey, Robert D., Hunt, Arthur B., and Sluder, Fletcher, S.: *AM. J. OBST. & GYNEC.* 45: 224, 1943.
4. Arnel, Rupert E.: *AM. J. OBST. & GYNEC.* 49: 49, 1945.
5. Huber, Carl: *AM. J. OBST. & GYNEC.* 49: 81, 1945.

SCOPOLAMINE AND APOMORPHINE IN LABOR

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DURING the past fifteen years the Boston Lying-in Hospital has taken an active part in developing a routine of pain relief in labor that would secure a high degree of amnesia with safety to the mother and with minimal effect upon the child. A constant guiding principle observed in the practice of employing pharmacologic agents for the purposes of accomplishing obstetric amnesia and analgesia has been little or no interference with the natural forces of labor. We maintain that a well-conducted spontaneous labor with intelligent supervision of the physiologic activity and needs of mother and child still remains the ideal method of delivery. We also should like to emphasize that the knowledge, experience, skill, and attention of the members of the obstetric team, rather than the drug-combination or technique of administration are the real determinants of the degree of safe relief to the parturient and her child.

Over a period of years we have found the most constantly useful drug in producing amnesia to be scopolamine. Our most successful methods of obstetric amnesia and analgesia include its use.

Clinically,^{1-7, 10} it has been shown repeatedly that there are no demonstrable changes in vital fetal functions when scopolamine is administered to the mother. Experimentally,⁸ Snyder has observed that fetal activity persists, even though scopolamine in large doses are injected directly into the umbilical vein.

Clinically, a major undesirable effect of scopolamine is the relatively frequent occurrence of excitement states. In the practice of anesthesiology and allied fields of medicine,⁹ apomorphine has been employed as a physiologic antagonist to states of delirium induced incidental to the use of various depressant drugs. In a review of the available medical literature, we note that the first attempt to use the combination of scopolamine and apomorphine in obstetrics was that by H. H. Johnson³ in 1925. For the past few years we¹⁰ have employed apomorphine in subemetic doses to effect sedation of the excited patient encountered in our administration of pain-relieving drugs at the Boston Lying-in Hospital. This interest led us to a more systematic clinical study of this drug-combination which serves as the basis for this report.

Procedure

We have employed the product marketed as scopolamine hydrobromide in fresh soluble tablet form. Irving¹⁰ has found no essential difference in the production of excitement between the levo-rotatory and dextro-rotatory forms, nor between the ampules and the tablets of scopolamine.

Scopolamine is the most reliable amnesic drug available. It produces psychic sedation and dreamless sleep. Among its parasympatheticolytic effects are dilatation of the pupil, dryness of mucous membranes of the respiratory tract, acceleration of pulse, prevention of the vagal type of carotid sinus syn-

drome (i.e., bradycardia, lowered arterial tension, and decreased pulse pressure), relief of bronchospasm, and, in certain instances, laryngospasm. Among its undesirable effects are flushing and dryness of the skin, particularly a flushed face, circumoral pallor, augmentation of sympathomimetic visceral traction reflexes especially in patients representing autonomic imbalance, and a cortical effect of uncontrollable excitement. Other very occasional untoward effects observed by us have been edema of one or both eyelids, edema of one or both lips and edema of the uvula. Although scopolamine may increase the maternal respiratory rate, we have observed no comparably demonstrable effect on fetal respiration.

Scopolamine may be administered by any route. Maximum effects may be expected within thirty minutes following subcutaneous or intramuscular injection. These effects occur in about one-fourth of the time when administered by the intravenous route. The duration of its effect is about two hours.

Apomorphine HCl is comparatively unstable in solution. The United States Pharmacopoeia¹² recommends that it be discarded if it imparts an emerald-green color when shaken with 100 parts of distilled water. However, we have found no essential change in the clinicopharmacologic actions of apomorphine solutions. Experimentally, there exists supportive evidence in the work of Garrell and Gray.¹³

To facilitate the use of apomorphine for our nursing staff we prepare solutions of the drug daily under sterile conditions. The solution is prepared by dissolving four tablets of $\frac{1}{10}$ grain (6 mg.) each, into 20 c.c. of sterile saline solution. This solution is contained in a sterile glass vial of 20 c.c. capacity, provided with a sterile rubber cap. The vial is then labeled "apomorphine solution, 1 c.c. = $\frac{1}{50}$ grain, 1.2 mg." and is placed in a dark area. Sterile normal saline solution is used as the diluent to prevent possible laking of the red blood cells should the solution be injected intravenously. Apomorphine solutions are rapidly absorbed from any parenteral site. Its maximal effects occur in about twenty to thirty minutes when injected intramuscularly or subcutaneously. If given by the intravenous route, these effects occur in about one-half of the time. The duration of effect lasts about two hours. When employing the intravenous route, the rate of injection of apomorphine solutions should be slower, taking about three to five minutes. The low threshold to nausea and emesis in the obstetric patient is too well known to need further emphasis.

Although apomorphine does not appear to potentiate directly the amnesic effect of scopolamine, it does appear to potentiate its analgesic action. It does this with but little or no apparent effect on the forces of labor and no observable depressant effect on the vital functions of the newborn.

In subemetic doses, apomorphine seems to have a central medullary and supramedullary action antagonizing the untoward scopolamine effects. Increasing the dosage of apomorphine results in stimulation of other medullary functions, more especially the hiccup, salivary, and vomiting centers.

The sedative dose of apomorphine has not been definitely established and varies greatly, depending on the existent state of cortical irritability. In adequate subemetic dosage the delirium induced by scopolamine is completely controlled. The patient becomes quiescent, but neither central depression nor change in vital functions of mother or fetus are usually manifest. Clinically, we were unable to observe any noticeable peripheral action of apomorphine.

Administration

The results of any method to effect obstetric analgesia and amnesia are no better than the knowledge, training, experience, and skill of the personnel employing that method. At the Boston Lying-in Hospital the house officer on duty orders the medication for the obstetric patient. The training, attention, and ex-

perience of the house officer are more often reflected in his judgment of pre-anesthetic medication than in any other phase of his development. Experience in the use of this routine of administration, particularly with regard to adjustment of dose, route, and time factors in relation to reflex irritability result in increasing success.

The actual administration of drugs are carried out by our nursing staff.

To obviate too great a discrepancy in the administration of the drugs employed, the following routine was finally adopted.

Preadnesthetic Medication for Patients in Labor

I. For psychic sedation:

Seconal gr. iii, by mouth or rectum (following admission enema)

II. For purposes of amnesia and analgesia:

A. Initial medication:

Scopolamine

Apomorphine gr. $\frac{1}{100}$

Administer when patient is making progress and begins to mind her pains.

B. Second medication:

Scopolamine gr. $\frac{1}{150}$

Apomorphine gr. $\frac{1}{50}$

Administer $\frac{3}{4}$ of an hour after A.

C. Subsequent medication:

Scopolamine gr. $\frac{1}{150}$

Apomorphine gr. $\frac{1}{50}$

Administer following B, and every two hours thereafter.

III. Standing Nursing Orders:

A. Except for seconal, all routine medication is to be administered intramuscularly.

B. Any change from routine medication must be checked before administration by resident physician.

C. Prior to initial medication, dentures are removed, and canvas bed-sides are placed on beds.

D. Apomorphine in doses of not over $\frac{1}{50}$ grain may be administered as often as ordered by house officer; minimal intervals of 15 to 30 minutes must be observed.

The house officer is encouraged to order apomorphine if the patient shows cortical excitation.

IV. Contraindications:

A. Do not use routine medication when excitement may be due to oxygen want, e.g., cases presenting shock, respiratory obstruction, or pulmonary edema associated with the pre-eclamptic toxemias.

B. Do not use in Class I or I A Cardiacs.¹⁴

Seconal was selected as the barbiturate of choice for hypnosis, for it not only is a member of the short-acting barbiturates, but also has never been involved in respiratory accidents or deaths at this hospital.¹⁰ Several modifications of our original regimen of medication were made. Our first efforts involved the use of 0.6 mg. of scopolamine and 1.2 mg. of apomorphine, followed by successive doses of 0.3 mg. of scopolamine and 1.2 mg. of apomorphine every two hours, but vomiting followed frequently. With the use of 0.6 mg. of each of the drugs initially followed in an hour and repeated two hourly thereafter with 0.3 mg. of scopolamine and 1.2 mg. of apomorphine, emesis was reduced, but amnesia-

analgesia was not as complete as we had hoped it would be. We then administered an initial dose of 0.6 mg. of each of the drugs, followed in one hour with 0.45 mg. scopolamine and 1.2 mg. of apomorphine, and two-hourly thereafter by 0.3 mg. of scopolamine and 1.2 mg. of apomorphine, with pronounced improvement in amnesia-analgnesia as well as in reduction of emesis; in fact, no more frequent vomiting than that seen in the unmedicated obstetrical patient.

With the prevalent nursing shortage our next step was further simplification of the regimen of medication. We studied the preparation of sterile solutions of apomorphine in rubber-capped containers, and observed no clinical-pharmacological changes. Interval doses of 0.6 to 1.22 mg. of apomorphine were now used whenever necessary to potentiate the sedative action of scopolamine or treat the symptom of overactivity during contractions in labor. The largest number of such interval doses given to any one patient was five doses of 1.2 mg. of apomorphine during a single one-hour period with desirable response.

It should be emphasized that the effective therapeutic dose of apomorphine varies with the existing state of cerebral irritability. The incidence of "slow" babies during this entire clinical investigation was very low.

Clinical Studies

Our experience with scopolamine-apomorphine amnesia and analgesia is limited to obstetric patients. The drug was used primarily as a premedicant during the first and second stages of labor to antagonize the marked overactivity encountered when scopolamine is used either with or without barbituric acid derivatives. Finally, we evolved a system of administration of these drugs where amnesia was complete, analgesia satisfactory, excitement markedly decreased and controllable, emesis reduced to a minimum, less strain put on the nursing staff, curiosity and interest of the house-staff is aroused, the labor room is comparatively quiet, and a method with reasonable safety for both mother and her baby.

Evaluation of Method

To evaluate the effectiveness of these premedicants, each patient was interviewed soon after emergence from anesthesia, the following day, and at various subsequent periods during her hospital stay. When seen soon after emergence the effectiveness of premedication more closely approximated to 100 per cent. However, when interviewed on succeeding days, it was observed that the patient-response to her medication during labor became influenced by uncontrollable factors, e.g., suggestion by her neighbors, visitors, and others. It was also learned that patients could not differentiate between amnesia and analgesia, for this reason the term amnesia-analgnesia is used.

These several findings were well illustrated by a study of multiparas to determine the comparative amnesic-analgesic effectiveness of this method to their previous experience with pain-relieving drugs during labor. It was revealed that about 11 per cent of this group were indifferent to this form of medication, whereas 47 per cent thought it better than any previous experience, 14 per cent thought this method certainly as good, and about 28 per cent were not certain whether his method was quite as good as some of their previous experiences. All primiparas were pleased with this method of amnesia-analgnesia during labor. By and large the induction and emergence phases were pleasant and peaceful, and devoid of discomfort for the mother.

The optimal routine of medication was finally studied on the last 300 cases of our series. Following this series over 1,000 more patients have received this regimen of medication. The data in the former group may be summarized as to amnesia-analgnesia in Table I.

TABLE I. AMNESIA FOR FINAL GROUP OF SERIES

	NO. OF CASES	PER CENT DISTRIBUTION
A. Complete amnesia	175	58
B. Cloudy recall of isolated incident	53	18
C. Cloudy recall of more than one incident	41	14
D. Clear recall of more than one incident	28	9
E. Orderly recall of several incidents	3	1

Considering the last group (E) as failures and excluding the group (D) with clear recall of more than one incident, the effectiveness of this drug-combination reaches 90 per cent. It is interesting to compare the effectiveness of this method of producing amnesia-analgesia with other studies made and reported at this hospital. Table II shows the comparative amnesic effect on the mother.

TABLE II. AMNESIA COMPARED WITH PREVIOUS REPORTS

METHOD (DRUG COMBINATION)	PER CENT EFFECTIVENESS	PERIOD
Morphine-scopolamine	39	Early ¹
Demerol-scopolamine	72	Recent ¹⁶
Barbiturate-scopolamine	86	Mid ^{1, 10}
Apomorphine-scopolamine	90	Present

Consequently, if we group (A), (B), and (C) in Table I together, we arrive at the figure of 90 per cent satisfactory amnesia. This compares very favorably with any of the previous studies in this hospital. In the groups (D) and (E) composing 10 per cent of unsatisfactory amnesia in this series, the patients received but a single dose of medication and with too little time for this dose to become maximally effective, or the medication was administered too late, or the patient failed to receive her medication at the desirably effective intervals, or the dosage of either premedicant was subminimal.

In the present study no serious untoward maternal or fetal effects were encountered. No cases of pulmonary complications or crises as pulmonary edema were seen. The untoward effects of scopolamine were well controlled when apomorphine was adequately administered.

Table III is an attempt to correlate the number of doses employed and the degree of amnesia-analgesia in the group of cases presented in Table I.

TABLE III. AMNESIA CLASSIFIED BY DOSAGE OF PREMEDICATION

NO. OF DOSES OF SCOPOLAMINE AND APOMORPHINE	GROUP A		GROUP B		GROUP C		GROUP D		GROUP E	
	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT
One	10	18	7	12	20	35	17	30	3	5
Two	73	61	22	18	18	15	7	6	0	0
Three or more	92	74	24	20	3	2	4	3	0	0

We may note that there is greater effectiveness of amnesia with the increase in the number of doses of premedicants. If the patients received three or more doses of scopolamine-apomorphine, the number of cases having complete amnesia was increased to 74 per cent, while those having satisfactory amnesia were increased to 96 per cent. We observed that the minimally effective amnesic state was usually reached about one-half to three-quarters of an hour following the second intramuscular dose of scopolamine-apomorphine.

TABLE IV. UNDESIRABLE MATERNAL EFFECTS

	EARLY TRIALS		FINAL REGIMEN	
	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT
Vomiting (moderate)	89	24.5	32	10.7
Vomiting (excessive)	3	1.5	4	1.3
Nausea without emesis	1	0.5	1	0.3
Excitement (moderate)	37	18.5	45	15.0
Excitement (marked)	6	3.0	11	3.7

Table IV shows the incidence of the more undesirable effects occurring with the use of these premedicants.

Since the principal use of apomorphine in the past has been as an emetic, special attention in this study was paid to this undesirable complication. In a previous study using demerol-scopolamine medication,¹⁶ nausea with or without emesis was reported in 25 per cent of cases. Emesis following almost any kind of medication in labor is not uncommon. It is frequently seen in the unmedicated patient particularly at the beginning of the second stage of labor. In this series moderate emesis occurred in only 10.7 per cent, under our final regimen; excessive emesis in only 1.3 per cent. Nausea without emesis occurred rarely.

Excitement occurs as a complication when scopolamine in any form or combination is employed. Barnett,⁵ using scopolamine alone, reported an incidence of 40 per cent. In our present series this undesirable effect occurred in 18.7 per cent; of this group but 3.7 per cent of cases showed rather marked excitement. We believe that more careful use of apomorphine would have reduced this group to a negligible occurrence.

There was no undesirable persistent effect seen on maternal blood pressure, pulse, or respiration. A few patients showed tachycardia which could be attributed to a scopolamine-effect inadequately met with apomorphine. A rather marked decrease in uterine activity was rarely seen; noted in five patients. This effect presumably was due to the use of medication before labor was definitely established.

Respiration, in general, showed signs of stimulation. This effect is due to scopolamine and could be neutralized by adequate apomorphine effect limited to subemetic doses. No respiratory crises were seen in this series. No cases with circulatory collapse were observed. Twitchings or convulsions were absent in this series.

Flushing of the skin and drying of the mucous membranes and skin was seen in most patients. No concomitant temperature elevation was seen. The patients would experience a generalized numbness, and drowsiness, and when properly medicated would sleep peacefully between pains. During hard uterine contractions, the patient would turn on her side or on occasion try to sit up in bed, mumble incoherently, and might exhibit meaningless picking motions with her hands.

Our impression was that our labor room with several patients in active labor medicated by this regimen was quieter than when patients were medicated with any of the previous scopolamine combinations. It is important to emphasize that when excitement did occur, larger interval doses of apomorphine controlled this complication without allowing the desirable effects to wear off. In no instance was there any demonstrable undesirable effect on the newborn.

Effect on Length of Labor

It is interesting to compare the effects of these drugs on the duration of labor with previous studies at this institution. The comparative effects on labor are recorded in Table V.

TABLE V. AVERAGE LENGTH OF LABOR IN HOURS

	PRIMIPARAS	MULTIPARAS	REPORT
Unpremedicated	16	12	Irving ¹⁷
Barbiturate-scopolamine	14.9	8.8	Rathbun ¹⁵
Demerol-scopolamine	12.4	7.6	Schumann ¹⁶
Apomorphine-scopolamine	11.3	6.5	present report

The distribution of cases in this study was 208 primiparas and 292 multiparas. Granted that it is difficult to determine accurately the time of onset of labor, nevertheless the comparative data charted here are arrived at the same hospital. In this institution, it is recorded as the time when uterine contractions begin to exert an effect on the cervix, either dilatation or effacement. For patients who are admitted late in the first stage of labor, the time when regular five-minute contractions began is taken as the onset of labor. The present series shows a significant reduction in average length of labor for both primiparas and multiparas.

Effect on Blood Loss

The estimated effect on blood loss in the third stage of labor in this series is charted in Table VI. Hemorrhage in the third stage of labor is influenced by many causes.

TABLE VI. ESTIMATED BLOOD LOSS

	NO. OF CASES	PERCENTAGE
Normal blood loss	463	92.6
Moderate hemorrhage	37	7.4
Severe hemorrhage	0	0

Where the total estimated blood loss was not over 200 c.c., the case came into the category of normal blood loss. In many instances in this group the estimated blood loss was 50 c.c. to 75 c.c. or less. Moderate hemorrhage was considered to exist when the estimated blood loss varied from 200 c.c. to 400 c.c. or a sudden acute loss of an amount estimated to be about 200 c.c. Most of the cases resulting in moderate hemorrhage had a definite cause e.g., lacerations or retained placenta, and only a small percentage (two cases) presented atonic uteri. All were controllable by oxytocics or indicated therapy. No undesirable effects could be correlated with the pre-medication employed in this series.

The absence of any cases of severe blood loss compares very favorably with studies reported in the literature. The following chart shows this relationship in Table VII.

TABLE VII. COMPARISON OF INCIDENCE OF SEVERE HEMORRHAGE¹⁹

AUTHOR	NUMBER OF PATIENTS	PER CENT WITH BLOOD LOSS OF 500 C.C. OR MORE
Adair et al.	51	13.7
Williams	1,000	13.0
Fortin	200	7.4
Pastore	500	6.4
Peckham and Kuder	19,200	6.14
Tucker and Benaron	14,156	4.2
Urner	7,500	3.4
Vaux and Mitchell	1,000	2.8 (inhalation)
Calkins	800	2.5
Brandt	800	1.25
Polak	2,000	0.30
Vaux and Mitchell	1,000	0.00 (cont. caudal)
Authors'	500	0.00

Effect on the Newborn Infant

To evaluate the effect of the premedicants on the infants, the following classification was used:

1. Immediate spontaneous respiration.
2. Delayed spontaneous respiration, i.e., infants cried and breathed without any resuscitative measures after a delay of one or two minutes.
3. Resuscitated easily, i.e., resuscitative measures consisted of inversion of baby with rubbing or gentle spanking on back of thorax and intermittent administration of oxygen-enriched air after clearing the airway.
4. Resuscitated with difficulty, i.e., measures which included tubbing, continuous administration of oxygen-enriched air, mouth to mouth insufflation, tracheal catheterization on occasion, and the use of an analeptic, e.g., coramine, 1 to 2 c.c. given intramuscularly.

The routine procedure following delivery is to grasp the feet, hold the infant with head downward, neck extended, and thus drain and aspirate with a bulb syringe the secretions from the air passages. Gentle rubbing of the back was all that was necessary to make the infant cry in nearly all cases.

The incidence of fetal morbidity and mortality in this series is shown in Table VIII.

TABLE VIII. FETAL MORBIDITY AND MORTALITY

STATUS AT BIRTH	NUMBER OF BABIES	PER CENT DISTRIBUTION
Immediate spontaneous respiration	415	82
Delayed spontaneous respiration	58	11
Resuscitated easily	24	5
Resuscitated with difficulty	7	1
Stillbirths	5	1

In this series of 500 deliveries there were 509 births, the difference being accounted for by 9 pairs of twins, 7 pairs of twins from multiparous mothers and 2 pairs of twins of primiparous mothers. The group "immediate spontaneous respiration" corresponded to the "active" group classified by previous reports from this clinic.¹⁷ The groups "delayed spontaneous respiration" and "resuscitated easily" correspond to the previous classification "slightly slow," and the "babies resuscitated with difficulty" corresponds to the "slow" group. On this basis 98 per cent of the newborns in this study were either "active" or "slightly slow," whereas but 1 per cent were either "slow" or stillborns.

That the routine use of premedication for purposes of obstetric amnesia and analgesia has actually been accompanied by a lower stillbirth and neonatal death rate at our hospital is unquestionable.^{17, 18} We attribute this effect to a more conservative policy in the conduct of labor.

It is interesting to compare our present results with previous studies at this hospital on the effect of premedication on the newborn. This comparative effect is indicated in Table IX.

TABLE IX. EFFECT OF PREMEDICATION ON NEWBORN

PREMEDICANTS	RELATIVE PERIOD	PERCENTAGE INCIDENCE OF "SLOW" BABIES
Morphine-scopolamine	Early	23 %
Barbiturate-scopolamine	Mid	3 %
Demerol-scopolamine	Recent	3.3%
Apomorphine-scopolamine	Present	1 %

In a previous study at this hospital¹ it was reported that in a control series without supplementary anesthesia 1.9 per cent of infants did not breathe immediately on delivery. Our present study shows an even greater improvement and this is very significant, since our cases include those receiving supplementary anesthesia.

That the nonvolatile pharmacologic agents may be potent influences affecting fetal morbidity and mortality is indicated above; compare the early period with the present, i.e., a reduction of 22 per cent "slow" babies. That definite progress has been made in the judicious use and application of premedication is unquestionable. We, therefore, contend that infant morbidity and mortality can be kept low and the mothers' comfort be given adequate consideration is not only probable but demonstrated. It should be borne in mind that factors other than premedication may operate to reduce the reflex irritability of the newborn. Exhaustion and its accompanying hypoxia or anoxia of the newborn may be due to such causes as prolapse and other dislocations of the cord, abnormal positions with possible prolapse of an extremity, or extensive premature separation, as well as other abnormalities of the uteroplacental site.

During the course of labor at least two important considerations should be constantly borne in mind; the degree and rate of progress, and evidences of either maternal or fetal exhaustion. Maternal exhaustion may become evident by the appearance of dehydration, tachycardia, restlessness, and alterations in the pattern and rhythm of uterine contractions. These findings should not be explained away on the basis of premedication. Fetal exhaustion may become evident with the appearance of hypoxia, especially change in rate or irregularity of rhythm of the fetal heart, and increased activity of the fetus in utero. The treatment of exhaustion rests principally on the judicious use of hydration, dextrose, vitamins, oxygen-enriched atmospheres, in addition to proper sedation, rather than by forced delivery. Often nothing is more dramatic than the correction of fetal hypoxia by continuous administration of adequately oxygen-enriched atmospheres to the mother.

After delivery of the fetus, its air passages are immediately drained and cleared, and continued application of oxygen-enriched air is applied until the infant breathes rhythmically and without thoracic retraction, its heart rate is well maintained, its skin pink, and its reflex irritability is normal. It goes without saying that gentleness at this stage is of prime importance.

We do not hesitate to apply fluid therapy when indicated. At the Boston Lying-in Hospital we maintain a constantly functioning blood-bank with a constantly available source of compatible bloods. Every mother is Rh typed in our antepartum clinic. When transfusion is indicated for the newborn a compatible Rh-negative donor is available; the mother does not serve as the donor.

TABLE X. CLASSIFICATION OF DELIVERIES

TYPE OF DELIVERY	NUMBER OF PATIENTS	PER CENT OF TOTAL
Multiparous normal	242	48.4
Primiparous normal	88	17.6
Multiparous low forceps	22	4.4
Primiparous low forceps	89	17.8
Multiparous breech extraction	11	2.2
Primiparous breech extraction	11	2.2
Multiparous twins	7	1.4
Primiparous twins	2	0.4
Manual or forceps rotation of head		
Primiparous	18	3.6
Multiparous	9	1.8
Hysterotomy	1	0.2

Table X is a classification of the type of delivery in this series.

Most of the multiparous normal deliveries are completed by fourth year Harvard medical students under supervision by the House Staff of the Boston Lying-in Hospital. Most primiparous normal deliveries are completed by the junior members of the House Staff. The other cases are delivered by senior House Officers under supervision of, or by members of the Resident Staff. All cases are seen by the attending staff.

It is not difficult to understand, therefore, that a variable period of time may elapse before accomplishing the delivery of the normal case. This may become a significant factor influencing the reflex irritability of the newborn, because of lack of skill and judgment in meeting the acute problem of establishing a clear airway as well as the time of exposure to anesthetic agents during delivery.

The incidence of cesarean section as reported in Table X obviously is lower than the actual incidence at this clinic. In general, scopolamine was not used extensively in patients having a test of labor, particularly following a previous cesarean section. However, this form of premedication has been used with much satisfaction in several cesarean sections subsequent to this study.

The gestational age of the patients at the time of delivery varied from 31 to 44 weeks. The distribution in this series is shown in Table XI.

TABLE XI. GESTATIONAL AGE IN WEEKS

Weeks	31	32	33	34	35	36	37	38	39	40	41	42	43
Number of Cases	1	3	3	2	3	9	9	54	65	198	88	51	14
Per cent of Total	0.2	0.6	0.6	0.4	0.6	1.8	1.8	10.8	13	39.6	17.6	10.2	2.8

About 40 per cent of the cases were delivered at term, i.e., at 40 weeks of gestation; and 91 per cent were delivered when having reached the gestational age of 40 ± 2 weeks. Prematurity as well as postmaturity contribute to increased maternal reflex irritability, among other reasons because of fear for the babies' lives. By and large, no depressing effects of this drug combination were noticeable even on the premature infant. The anesthetic and obstetric risk of the mothers in this series of cases was good. In other words, by and large the patients delivered at this hospital have attended our various antepartum clinics for evaluation.

The risk of the fetus is dependent among other things on its state of maturity; age, parity, and physical status of its mother; occurrence of accidents of labor and various forms of dystocia; duration and character of labor; type of delivery; occurrence of intrauterine asphyxia; experience, skill and judgment of the obstetric team; as well as the amount and duration of pre-anesthetic depression and depth of anesthesia during delivery. Clifford and Irving,¹⁸ in reporting a study at the Boston Lying-in Hospital, had shown that the type of premedicant, its dose, and time of administration have a definite relationship to prematurity and the accompanying immaturity of the fetus in their bearing on mortality and morbidity of the newborn.

In this study we found no significant correlation between the time of administration of the pre-anesthetic agents employed and fetal mortality. These observations apply also to those cases presenting prematurity in the absence of other complicating factors.

No effort was made in this study to differentiate complications as due to pre-existing condition of the patient, anesthesia, and its administration, or that due to obstetric procedures. That the postmature infant stands a greater chance

TABLE XII. PREPARTUM COMPLICATIONS (SERIES OF 500 CASES)

COMPLICATION	NUMBER OF PATIENTS
Allergy	1
Anemia	12
Asthma	1
Bronchitis	1
Cystitis	5
Diabetes mellitus	1
Epilepsy	1
Essential hypertension	1
Peripheral neuritis	1
Pyelitis	10
Syphilis	4
Tuberculosis	4
Upper respiratory infections	50
Pre-eclamptic toxemias	46

TABLE XIII. COMPLICATIONS OF LABOR IN THIS SERIES

COMPLICATION	NUMBER OF PATIENTS
Dystocia	
Cervical stenosis	1
Inertia	51
Outlet contraction	12
Rigid perineum	47
Shoulder	2
Incarcerated anterior lip of cervix	2
Malpositions	
Breech	29
Persistent occiput posterior	20
Persistent occiput transverse	10
Transverse	1
Twins	9
Occult prolapse of cord	1
Premature labor	14
Premature rupture of membranes	19
Premature separation of placenta (partial)	3
Prolapsed cord	5
Retained placenta	6
Ruptured marginal sinus of placenta	1

TABLE XIV. POSTPARTUM COMPLICATIONS

COMPLICATION	NUMBER OF PATIENTS
Aspiration of vomitus	1
Atony of uterus	2
Backache	2
Cystitis	32
Endometritis	10
Headache	11
Laryngitis with edema of uvula	1
Lymphangitis of breast	10
Phlebitis (superficial of leg)	1
Pyelitis	4
Retained lochia	1
Retained secundines	4
Retention of urine	24
Subinvolution of uterus	14
Oligogalactia	48
Fissured nipples	24

of succumbing either before or during labor is now generally accepted as a fact.¹⁵ That many factors other than premedication influence the condition of the newborn is also unquestionable.¹⁸

The maternal complications presented by this series of cases are grouped into three categories, prepartum complications, complications of labor, and postpartum complications. Their distribution and occurrence are presented in Tables XII, XIII, and XIV, respectively.

This regimen of premedication was not used in patients presenting the prepartum complication of heart disease classified as I or I-A.¹⁴ The group of patients presenting the prepartum complications referable to the function of respiration, e.g., asthma, bronchitis, and upper respiratory infections, were not only improved with this group of pre-anesthetic agents, but in many instances were actually cured of their disease. However, we are not offering this regimen of medication for the patient in labor as a universal cure for upper respiratory infections.

It is interesting to observe that of the 50 cases presenting upper respiratory infection, including cough, none had their postpartum convalescence complicated by any respiratory abnormality. There was not a single instance of postpartum major respiratory complication. We think a major beneficial therapeutic effect was contributed by the scopolamine-apomorphine regimen used during labor.

The case complicated by aspiration of vomitus was a 33-year-old para iv, essential III, at thirty-seven weeks of gestation with adequate pelvis, terminating in six hours of labor by normal delivery of a 10 pound, 13 ounce baby. The placenta was delivered in twenty minutes. The emesis occurred during open drop ether induction. The patient made an uneventful recovery and was discharged with her baby well on the twelfth postpartum day. Premedication cannot wholly compensate for the deficiencies of personnel attempting to administer anesthetics.

Atony of the uterus is of great importance to both the obstetrician and anesthesiologist. Premedication and anesthesia may well be considered among the many known and unknown causative factors producing this serious complication of labor. However, in this series scopolamine-apomorphine premedication could not be assigned as an etiologic factor leading to atony of the uterus.

The anesthetic agents and techniques employed for the completion of the different types of deliveries are shown in Table XV.

TABLE XV. DISTRIBUTION OF ANESTHETIC AGENTS AND TECHNIQUES

	NUMBER OF CASES	PER CENT OF TOTAL
Inhalational techniques:		
Ether	308	61
Gas, oxygen, ether and/or vinethene	58	11
Regional techniques:		
Procaine	122	24
None	21	4

The number of cases listed refers to the newborns. Inasmuch as the pre-anesthetic agents employed are constant factors within limits,² the differential anesthetic factors influencing the newborn during completion of the delivery must be either one or more of the following:

1. The anesthetic agent.
2. The anesthetic technique.
3. The depth and duration of anesthesia required or maintained.
4. The obstetric complication presented by both mother and her fetus.

5. The ability, training, experience, attention and skill of the members of the obstetric team.

Under inhalational techniques are included open drop, semiclosed, and closed carbon-dioxide absorption, both circle filter, and to and fro (Waters) techniques. Where ether is listed in Table XV, is meant chiefly open-drop technique. By G.O.E. and/or V. are meant the nitrous oxide-oxygen-ether sequence with or without vinethene re-induction following delivery of the baby, employing the carbon-dioxide absorption closed system. The nitrous oxide-oxygen mixture at no time exceeds 50 to 60 per cent nitrous-oxide. Oxygen-enriched atmospheres are supplied during the terminal portion of the second obstetric stage, and maintained until the cord stops pulsating. The delivery is actually accomplished in the topmost portion of the first plane of the third stage of anesthesia. The accumulation of carbon dioxide in such highly oxygen-enriched atmospheres are never permitted to accumulate. The retention of carbon dioxide with its attendant disturbance in oxygen-carbon dioxide equilibrium are too well established to need further elaboration.

Under regional techniques are included spinal block and occasionally infiltration with procaine. When employing subarachnoid block, a serious attempt was made to limit the level of anesthesia to dermatomes 9 to 11. The interspace selected for injection of the agent was L4 or L3. Vasopressor substances were employed when indicated, the agent of choice was ephedrine sulfate. Incidentally, ephedrine sulfate was also used on occasion with inhalation anesthesia for its analeptic effect on the baby.¹⁰

By the group "none" in Table XV is meant the instances where delivery was accomplished without complementary or supplementary anesthetic agents. The entire delivery, including all three obstetric stages, was performed on the basis of the premedicating agents. No difficulty was encountered in this group. All the babies cried immediately on delivery. The personnel administering the anesthetics in this series of cases were of variable training, experience, skill, and judgment. The open-drop technique was employed by the nurse-anesthetists, house-officers, and some of the older members of the obstetric staff. The closed inhalation techniques were employed by the anesthesiologist member of the staff. The regional techniques were administered by the resident obstetricians or the anesthesiologist.

Table XVI is an attempt to correlate the anesthetic agent as an index of the entire anesthetic procedure with the infant's response at the time of delivery.

TABLE XVI. INFANT RESPONSE VS. ANESTHETIC AGENT

	ETHER		PROCAINE		G.O.E. AND/OR V		PREMEDI-CANT ONLY		TOTALS	
	NUM-BER	PER CENT	NUM-BER	PER CENT	NUM-BER	PER CENT	NUM-BER	PER CENT	NUM-BER	PER CENT
Immediate spontaneous respiration	250	81	111	91	33	57	21	100	415	82
Delayed spontaneous respiration	31	10	7	6	20	34	0	0	58	11
Resuscitated easily	17	6	3	2	4	7	0	0	24	5
Resuscitated with difficulty	6	2	1	1	0	0	0	0	7	1
Stillborn	4	1	0	0	1	2	0	0	5	1
Totals	308		122		58		21		509	100

That the degree of narcosis and the differential anesthetic influences enumerated are potent factors affecting the irritability of the newborn is indicated in this table. When ether was employed, the depth of narcosis to which the mother was exposed usually corresponded to lower first or top second plane of third

stage of Guedel's classification. When other inhalational agents were employed, the depth of anesthesia corresponded to mid or top of first plane and even on occasion to lower second stage. Whereas when procaine or no added anesthetic agent was employed, the depth of narcosis corresponded to the bottom of second stage.

The troublesome complications of headache and backache occurred much more frequently where the regional anesthetic procedures were employed. No headache or backache occurred in the group where premedicants only were used. Transient headache of no troublesome nature occurred in the inhalational group only about one-tenth as often as a complication following spinal anesthesia; headache in the postspinal group was of a troublesome character when present.

The best showing is in the group where premedicants alone were used to accomplish delivery, indicating that these pharmacologic agents are comparatively harmless to mother and infant. The stillborns in each category have an adequate explanation based on definite pathologic findings not even remotely related to the premedication or anesthetics.

When employing the inhalation anesthetic agents, slightly more agent is required for induction with this regimen of premedication as compared with the premedicants previously reported from this hospital. A basic explanation for this phenomenon is the occurrence of less depression during labor when scopolamine-apomorphine amnesia and analgesia are employed. Incidentally maintenance of anesthesia requires no more agent than that used with previous premedicants. Emergence from anesthesia is reported by most patients as pleasant or in more glowing terms.

Referring again to Table XVI, we note that immediate spontaneous respiration and immediate cry on delivery occurred in 100 per cent of the infants delivered with an effective regimen of scopolamine-apomorphine. Considering the group resuscitated with difficulty as equivalent to "slow" babies, we note that none occurred when premedicants alone or closed inhalation carbon-dioxide absorption techniques were used. On the other hand, slow babies occurred in the group where ether alone or procaine (spinal anesthesia) was used to complete the delivery. Earlier in this paper it was pointed out that factors other than anesthetic agent and technique may operate to cause depressed reflex-irritability of the newborn.

Summary and Conclusions

Apomorphine in subemetic doses and scopolamine have been used to produce amnesia and analgesia in labor in a series of 500 patients at the Boston Lying-in Hospital. The use of a short-acting barbiturate (seconal) in limited hypnotic doses was employed early in labor before uterine contractions reached the intensity of pain to require the full regimen of medication. The object of this study was to determine the maternal and fetal effects of this combination of pharmacologic agents.

Our primary objective in medicating the obstetric patient during labor is the production of complete amnesia and a degree of analgesia that is consistent with safety for mother and baby. For the former objective we have always employed scopolamine as the amnesic drug of choice at this hospital. To potentiate its analgesic effect, various efforts have been made in the past. There are certain merits in each system. There also have occurred in the past certain undesirable side-effects, some complications of a nonpredictable nature, and uncontrollable

depressed states of mother and baby. To obviate these occurrences and still retain the advantages, we have employed apomorphine in subemetic doses. When used properly this pharmacologic agent has proved an invaluable aid to the armamentaria of the obstetrician aiming to accomplish safer amnesia and analgesia in labor. The regimen of medication with scopolamine-apomorphine does not appear to influence the progress of the natural forces of labor.

The properties of scopolamine and apomorphine are briefly reviewed from the obstetric point of view. Their manner and method of administration are suggested.

The effectiveness of this drug-combination compares very favorably with other methods employed by us in the past. This method may be used in conjunction with other known and accepted procedures of accomplishing obstetric amnesia and analgesia. When so used, the amounts of other premedicants as the barbiturates or demerol may preferably be decreased or eliminated.

The average primiparous labor in this series was 11.3 hours, the average multiparous labor was 6.5 hours. Apomorphine-scopolamine premedication does not appear to influence the third stage of labor; blood loss compares favorably with those reports appearing in the literature.

This combination exerts no demonstrable depressant effect on either full-term or late premature infants. It may be administered by any route. No demonstrable influence on fetal morbidity or mortality can be seen when the premedicants alone are used to complete the delivery. On the whole, this combination is better from both maternal and fetal standpoints than other methods employed at this hospital.

Scopolamine-apomorphine help to reduce the incidence of postpartum respiratory complications even in the group presenting some prepartum respiratory complication. Other complications are no greater than occur substantially in a corresponding group of nonpremedicated obstetric patients.

As shown previously,²⁰ the anesthetic agent and technique employed to complete the delivery is not as important as the ability, training, skill, attention, and experience of the person administering the anesthesia. The training and skill of the individual obstetrician may frequently be the determining factor as to the degree and duration of narcosis required to complete the delivery. Obstetric procedures that can be well and skillfully executed under top first-plane anesthesia should not have more profound narcosis. The supply of highly oxygenated atmospheres to the mother for its effects on both mother and baby is consistent with good practice of obstetric anesthesia.

There is much yet to be learned about the pharmacology of apomorphine in subemetic doses. This might prove a fruitful field of investigation for the experimental pharmacologist. Apomorphine hydrochloride in subemetic doses is a valuable addition to the clinical therapeutic agents employed by the anesthesiologist and the obstetrician.

We wish to thank Dr. Frederick C. Irving for many valuable suggestions throughout this study.

References

1. Irving, F. C., Berman, S., and Nelson, H. B.: *Surg., Gynec. & Obst.* **58**: 1-12, 1934.
2. Waters, R. M., and Harris, J. W.: *Am. J. Surg.* **48**: 129-134, 1940.
3. Johnson, H. H.: *Anesth. & Analg.* **4**: 199-207, 1925.
4. Somerville, A.: *Canad. M. A. J.* **24**: 818-820, 1931.
5. Barnett, T.: *Brit. Med. J.* **1**: 940-942, 1934.
6. Stevens, W. J.: *Canad. M. A. J.* **42**: 172-173, 1940.
7. Kirschbaum, H. M.: *AM. J. OBST. & GYNEC.* **44**: 664-672, 1942.
8. Dreisback, R., and Snyder, F. F.: *Proc. Soc. Exper. Biol. & Med.* **48**: 197-198, 1941.
9. Rovenstine, E. A., and Hershey, S. G.: *Anesthesiology* **6**: 574-579, 1945.
10. Irving, F. C.: *Rhode Island Med. J.* **28**: 493-496, 1945.
11. Adriani, J.: *The Chemistry of Anesthesia*, ed. 1, Springfield, Ill., 1946, Charles C Thomas, pp. 270-272.
12. *The Pharmacopoeia of the United States of America*, revision 12, Nov. 1, 1942, pp. 60-61.
13. Garrell, J. E., and Gray, P. L.: *Proc. Soc. Exper. Biol. & Med.* **25**: 619-622, 1928.
14. Hamilton, Burton E., and Thomson, K. J.: *The Heart in Pregnancy and the Child-bearing Age*. Chapt. I.—Classification, 1941, Little Brown & Co.
15. Rathbun, L. S.: *AM. J. OBST. & GYNEC.* **46**: 278-283, 1943.
16. Schumann, Wm. R.: *AM. J. OBST. & GYNEC.* **47**: 83-104, 1944.
17. Irving, F. C.: *Outline of Normal and Abnormal Obstetrics*, Lithoprinted by Edwards Brothers, Inc., 1943.
18. Clifford, Stewart, H., and Irving, Frederick C.: *Surg., Gynec. & Obst.* **65**: 23-30, 1937.
19. Vaux, N. W., and Mitchell, R. M.: *J. A. M. A.* **124**: 549-555, 1944.
20. Harris, J. W., and Waters, Ralph M.: *J. Missouri M. A.* **37**: 369, 371, 1940.

SURFACE TENSION AS A FACTOR IN THE RESISTANCE OF NEONATAL LUNGS TO AERATION

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MOST of those who have examined the lungs of stillborn and newborn infants are impressed with the large number of cases in which amniotic fluid fills the alveoli. From this and other observations some investigators have been led to assume that aspiration of amniotic fluid occurs normally in every fetus, whereas others deny this. Since it has not as yet been possible to determine unequivocally the normal state of the lungs just before birth, we must rely for an answer on the evaluation of the circumstantial evidence.

When comparing the lungs of stillborn infants with those of newborn infants who have breathed for a few hours or days, one observes the following unexpected difference. In stillborn infants all the alveoli are usually uniformly expanded with fluid, whereas in many liveborn infants areas of complete atelectasis alternate with aerated portions for days after birth. An effort has been made to explain this difference, and its results will presently be described.

Before discussing the findings in infants with aspiration of fluid or atelectasis, brief reference should be made to the eminent importance of these conditions. Beck¹ found that 41.5 per cent of all neonatal deaths in his material were due to intermittent cyanosis with atelectasis. This apparently includes all fatal cases with poor aeration of the lungs, as no separate figures for aspiration of amniotic fluid are given.

As will be apparent from what follows, it is important to distinguish three conditions of the lungs of newborn infants, namely, atelectasis, aeration, and expansion with fluid. Upon gross examination at autopsy it is easy to recognize aeration. However, true atelectasis and expansion with fluid can only be distinguished from each other by microscopic examination except in cases of aspiration of extreme amounts of amniotic sac contents. This has been emphasized by Farber and Sweet.² Unfortunately, many authors have classified all nonaerated lungs as atelectatic. This is probably due to the necessity of making a provisional anatomic diagnosis at autopsy, based on the gross appearance alone. In order to avoid the unjustified diagnosis of atelectasis in these cases, we have adopted the policy at the autopsy of listing as "nonaeration" the condition of all lungs of stillborn infants and newborn infants which are not aerated or grossly filled with amniotic sac contents. The specific diagnosis of atelectasis or aspiration of amniotic fluid is only made when microscopic sections are available.

Review of the Literature

It has been assumed that the fetus normally performs respiratory movements and aspirates amniotic fluid. A review of the older literature on this

subject has been given by Farber and Sweet.² More recently several authors have supported this view and based their contention on two lines of evidence. One is the observation of animal fetuses in utero³⁻⁵ and the other is the presence of amniotic fluid in the alveoli of stillborn or newborn individuals.⁶ Some workers^{3, 5} go so far as to assume that a rhythmic flow of amniotic fluid is essential for the normal development of the lungs. Patterson and Farr⁷ hold that atelectasis is abnormal in the fetus, and that it is produced by solid material such as vernix, obstructing the allegedly normal flow of fluid in the bronchial tree.

As evidence for the normal occurrence of intra-uterine respiratory movements, Snyder and Rosenfeld⁸ describe experiments in which uteri of rabbits were exposed and India ink injected into the amniotic cavities. The particles were recovered in the lungs except in those cases in which respiration was depressed by drugs. Actually this proves only the susceptibility of the fetal organism to those drugs. Potter and Bohlender⁸ found normally developed lung tissue with fluid in the alveoli in maldeveloped fetuses in which there was no communication by which amniotic fluid could have been aspirated. They conclude that the alveolar fluid in their cases was secreted and that a tidal flow of amniotic fluid is therefore not essential for the normal development of pulmonary tissue.

Reifferscheid and Schmiemann,⁹ and Ehrhardt¹⁰ injected x-ray opaque material into the amniotic cavity of human fetuses, and followed by radiography of the fetus in utero the ingestion and aspiration of the substance. These observations were made while the fetus lived under normal conditions, as far as one can determine. Yet, the histologic sections of Reifferscheid and Schmiemann's cases show the injected material in lumina much more widely distended than is usual in the fetal lung. Ehrhardt points out that the thorotrast must be concentrated in the lungs in order to cast a shadow, because of the great dilution by amniotic fluid. This concentration is believed to be due to absorption of fluid on the lungs. Very recently, Davis and Potter¹¹ made similar experiments and injected thorotrast into the amniotic cavity of human fetuses a few hours or days before the termination of pregnancy. No roentgenograms of the fetuses in utero were made. The full-term fetuses were delivered by cesarean section. All survived, and part of them showed by x-ray thorotrast in the lungs. Younger fetuses were obtained from pregnancies terminated by hysterectomy. They were delivered by incision of the uterus in situ, and "all made repeated respiratory efforts" while they were being taken to the x-ray laboratory. Almost all of them showed thorotrast in the lungs. The authors' conclusion that the material was aspirated in utero, is however, not compelling. It is well known that amniotic sac contents are always ingested by the fetus. In these cases mouth, pharynx, and the larger air passages were filled with thorotrast as can be seen in the published roentgenograms, so that considerable amounts of this material may have been aspirated after delivery. Ligatures placed around the neck of the fetus in order to prevent such aspiration, were apparently inadequate. As the authors themselves admit, the majority of the microphotographs in their report show evidence of extrauterine respiration.

Potter and Adair¹² assume that the fetus normally aspirates amniotic fluid, and illustrate this by a photograph of a lung section from a fetus at term (presumably stillborn) with partially expanded alveoli with fluid. On the other hand, they show a section from a liveborn infant with but a few alveoli aerated by artificial respirations, and the rest of the tissue completely atelectatic. No explanation of this difference is given. In view of similar findings to be described below, and in accord with other workers to be quoted presently, one may explain this as abnormal aspiration in the former specimen, and normal atelectasis in the latter.

Windle⁸ and co-workers¹³⁻¹⁵ have criticized the animal experiments of the above-mentioned authors and pointed out that such procedures as laparotomy, even without opening the uterus, may upset the oxygen supply of the fetus and stimulate respiratory movements. Their own experiments consisted of the injection of thorotrast into the amniotic cavity of guinea pigs, and subsequent x-ray examination of the fetuses in situ.¹³ As long as there was no further interference, the fetus was apneic and did not aspirate amniotic fluid. As soon as anoxia occurred the injected material entered the lungs. The authors also mention six cases of amniography in human subjects, with no evidence of aspiration as seen by x-ray in situ. If an animal fetus was preserved in such a manner that anoxia was prevented during the experiment, its lungs were found to be atelectatic. However, if there was any delay during the manipulation, the fetus started to gasp in utero and then presented aveoli expanded with fluid, similar to those of human stillborn infants.¹⁴ Other authors who have examined human newborn infants believe that true atelectasis is the normal condition of the fetal lung.¹⁶⁻¹⁸ Windle¹⁵ acknowledges that the lungs of stillborn infants show aveoli distended with fluid and explains this by terminal anoxia and consecutive pathologic aspiration. Potter¹⁹ states that if the presence of fluid in the aveoli is evidence of asphyxiation, "this discussant has never seen a nonasphyxiated stillborn fetus among almost three thousand." Some authors feel that this conclusion, which is apparently not accepted by Potter herself, is correct.

Zettelman²⁰ examined the lungs of two stillborn anencephalic monsters, and found them to be atelectatic. He assumes that this is the normal condition in utero, which was preserved in these cases because there was no intact respiratory center to respond to anoxia just before birth. However, one might object that the same defect of the respiratory center also prevented whatever respiratory movements may normally occur in the fetus, and that therefore the condition in these anencephali was not the normal one.

All observers agree that the presence of much solid or fatty material in the aspirated fluid constitutes a danger because it may obstruct air spaces or stimulate an inflammatory reaction. It is common knowledge that amniotic fluid usually does not irritate the lung tissue even if it contains cornified cells, fatty vernix or meconium. Yet, all writers²¹⁻²⁶ agree that congenital pneumonia which is relatively rare, occurs only in those lungs which contain aspirated amniotic sac contents.

The factors which may resist the aeration of an atelectatic lung after birth have been studied by Wilson and Farber,¹⁶ and summarized as follows: cohesion of the moist surfaces of collapsed aveoli; imperfectly developed or injured respiratory center; an imperfectly developed thoracic mechanism; bronchial obstruction. To these factors Clifford²⁷ added another, namely, an increased turgor of the lung tissue due to congestion, edema, or hemorrhage.

Observations

Microscopic Examination of Lungs.—The morphology of the lungs of stillborn and newborn infants has repeatedly been examined, and findings in the present series are not different from those previously described. A series of 30 stillborn and 30 newborn infants up to three days of age were used to outline the stages in the expansion of the lungs with fluid or air, and indicate the frequency of their occurrence. The stages in the expansion of lungs are presented in a diagram (Fig. 1). Sections of representative examples are shown in Figs. 2 to 7. The incidence of these conditions in the present series is given in Table I.

Complete or nearly complete atelectasis (Fig. 2) is sometimes seen in young infants, and rarely in stillborns. It is therefore apparently uncommon for a fetus to die without a terminal episode of anoxia with respiratory movements.

In one of the two stillborns in the present series that showed atelectasis, the aspiration of fluid was prevented by masses of thick mucus filling the large bronchi.

The manner in which a lung is expanded with fluid is different from that of expansion with air. If both occur in the same lung, it is obvious that aspiration of amniotic fluid precedes that of air. As was mentioned above, the principal argument concerns the regularity with which fluid is aspirated by the normal fetus. There is no lung in the present series in which one could be sure that no fluid had been aspirated in utero. Small amounts of fluid as they are present in every lung will not be mentioned in the following classification. This fluid is of no significance because, as Snyder and Rosenfeld⁶ point out, the surface of the alveoli increases so much in subsequent air breathing that the amount of fluid is negligible.

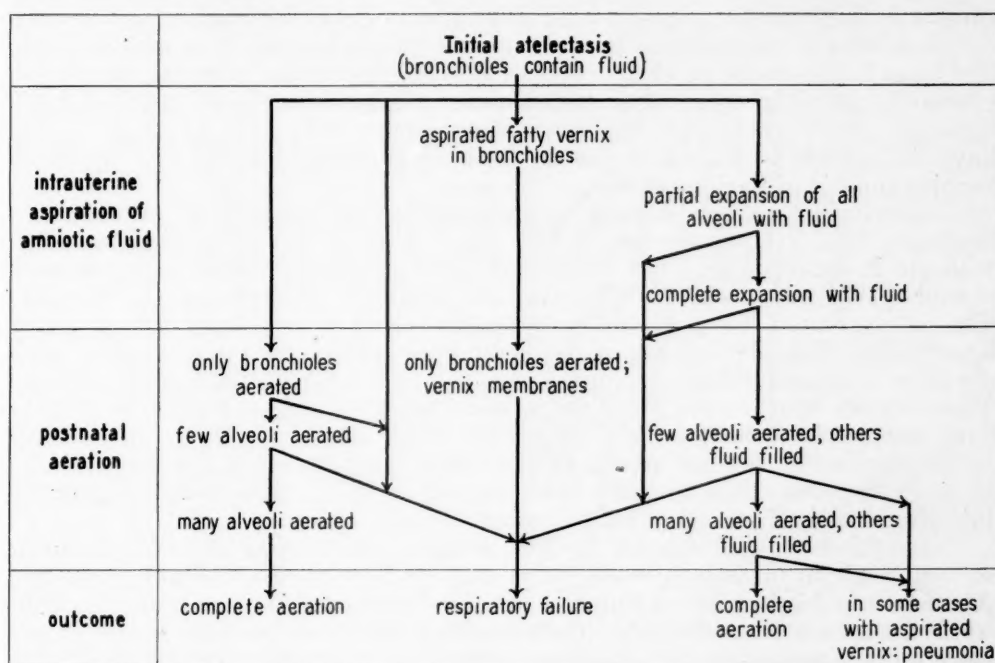


Fig. 1.—Diagram of the conditions produced in the lungs by aspiration of amniotic fluid, or air, or both.

More extensive expansion with fluid affects all alveoli almost uniformly. Thus, a lung expanded in utero goes from atelectasis to a state of diffuse partial expansion of all alveoli. All spaces are open but are flat and their walls are wavy and obviously not under tension (Fig. 4). As more fluid enters, the alveoli become polygonal with approximately equal diameters in all directions. These are referred to in Fig. 1 and Table I as complete expansion with fluid. However, it can be seen that the alveolar walls are still not completely stretched and have on section more or less wavy outlines (Fig. 5). Förster¹⁸ has called attention to the fact that histologic stains for elastic fibers show wavy alveolar walls if a lung is filled with aspirated fluid, in contrast to straight walls in aerated lungs. In the present series no case was found in which the alveoli were distended with fluid to the same extent as is found in aeration. However, the difference in alveolar size between lung tissue completely expanded with

TABLE I. STATE OF EXPANSION OF THE ALVEOLI IN 30 STILLBORN INFANTS AND 30 NEWBORN INFANTS UP TO 3 DAYS OF AGE

	STILLBORN	NEWBORN
Atelectasis (bronchioles filled with fluid or air)	2	8
Few alveoli expanded with air	-	6
Areas of expansion with air predominant	-	4
Mixed expansion with fluid and air	-	10
Diffuse partial expansion with fluid	17	1
Complete expansion with fluid	11	1
	30	30

fluid and with air is not great, as will be seen later in a case of mixed expansion (Fig. 7). The aspirated fluid may be clear or contain various amounts of fatty vernix, cornified cells, or bile-stained meconium. The appearance of these substances in sections of lungs has been described in detail by Farber and Sweet.²

The present observations do not support the assumption that atelectasis in the fetus is the result of obstruction of bronchi by vernix.⁷ Atelectasis is not commonly found in those lungs which contain large amounts of aspirated solid material. Stillborn infants who often show much vernix in their lungs, do not have atelectasis as frequently as do liveborn infants who had not aspirated vernix, and die of various causes.

Aeration of atelectatic lung is preceded by the entrance of air into the bronchial tree. It is not rare to find only the bronchi and bronchioles filled with air in infants that lived for several hours, without aeration of the alveoli proper (eight cases, see Table I). In some instances further progress of aeration is prevented by previously aspirated vernix which lines the air-filled bronchioles (Fig. 3). When a predominantly atelectatic lung expands with air there is no intermediate condition in which all alveoli are partially expanded. Those alveoli which contain air are completely expanded, and are side by side with completely atelectatic ones (Fig. 6). Expansion proceeds by an increase in the number of aerated alveoli rather than a gradual increase in the volume of every alveolus, as is the case in aspiration of fluid. The probable cause of this difference is discussed in the following section.

One-third of all lungs of liveborn infants in the present series show on section no air in the alveoli, being either atelectatic or filled with fluid (Table I). Another one-third of these lungs showed full aeration of part of the alveoli, while the others are atelectatic. The remaining one-third has part of the alveoli more or less expanded with fluid and other alveoli aerated. It is obvious that in these lungs fluid was aspirated in utero but not in large amounts, so that after birth air could be aspirated in addition. Here, as in the partly aerated lungs described above, the air has accumulated in some alveoli and fills these completely, while others contain no air. If the fluid in some of the alveoli contains no solid or fatty debris, it may not show in histologic section, and be mistaken for aeration. It is then necessary to examine the alveolar walls. Aerated alveoli have straight or uniformly curved walls, whereas after aspiration of fluid the walls are somewhat wrinkled so that a cross-section appears wavy. The difference in the appearance of the alveolar walls after aspiration of fluid or air is shown in Fig. 7.

Figs. 2-7.—Sections of lungs of infants, showing various stages of aspiration of fluid or air. Hematoxylin-eosin stain (X55).

Fig. 2.—Three and one-half-hour infant. Complete atelectasis.

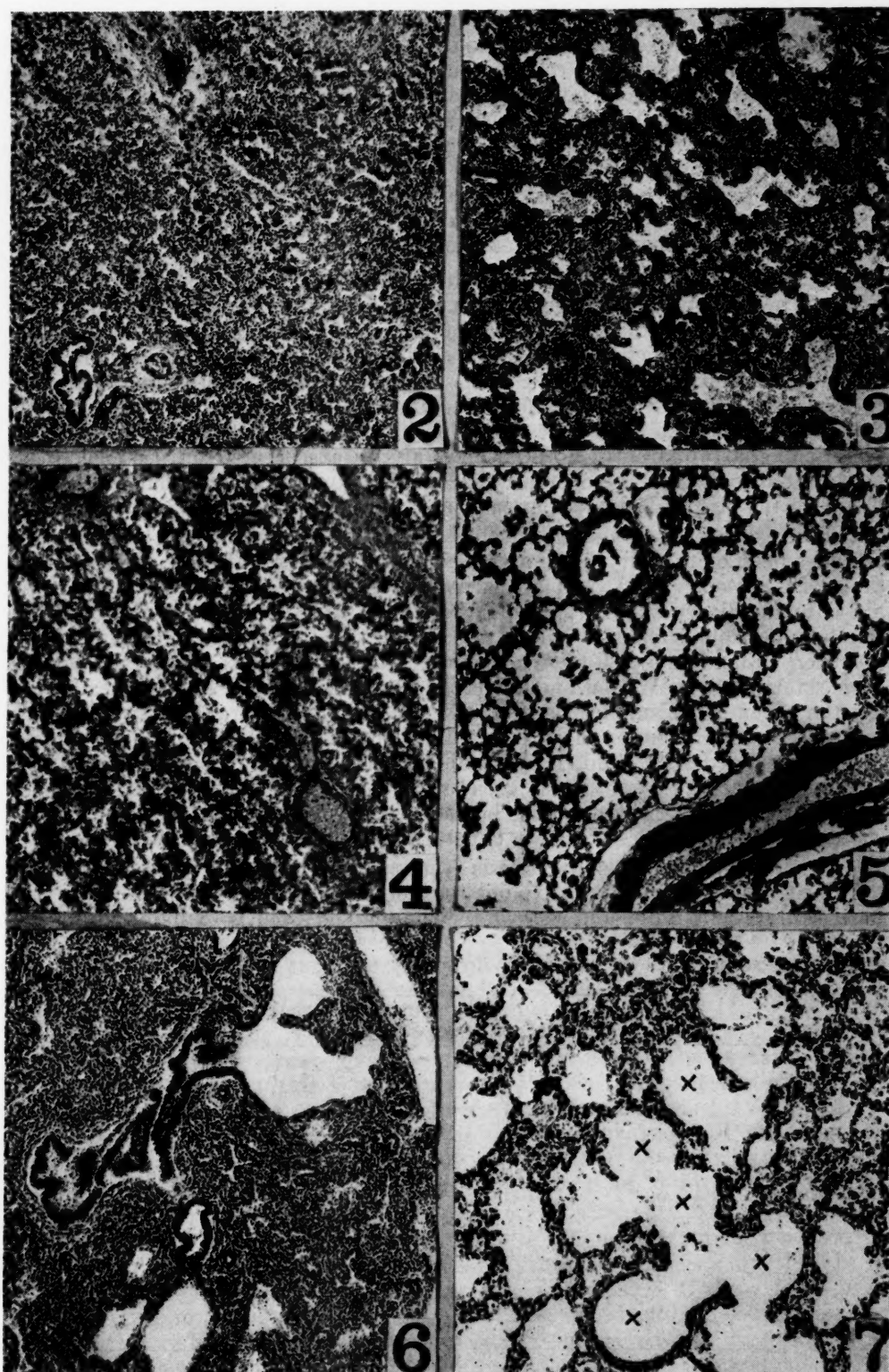
Fig. 3.—Ten-hour infant. Atelectasis; bronchi filled with air or fluid, and lined with vernix membranes.

Fig. 4.—Stillborn infant. All alveoli are partially expanded with fluid.

Fig. 5.—Stillborn infant. All alveoli are expanded with fluid.

Fig. 6.—Three and one-half-hour infant. A few alveoli are fully expanded with air, all others are atelectatic.

Fig. 7.—Some of the alveoli (X) are fully expanded with air; others are expanded to a less extent with fluid.



Figs. 2 to 7.—(For legend see opposite page.)

The relative amounts of aerated and fluid-filled lung tissue vary greatly in these cases of mixed expansion, and it depends on several factors whether or not adequate respiration can eventually be established. Apart from extrapulmonary conditions, one must consider not only the amount of aspirated fluid but also its nature. The infant with its low oxygen requirement may survive with partly aerated lungs until a clear fluid is absorbed. On the other hand, solid or fatty debris will remain in the alveoli and either mechanically prevent aeration or produce pneumonia, particularly when infection supervenes.

The Mechanism of Expansion With Fluid and With Air

Several observations suggest that there is in the lung tissue a greater resistance to aeration than to expansion with fluid. It takes an infant several days of breathing to fill all or most of the alveoli with air, whereas in utero periods of anoxia which can hardly be assumed to last even as long as one hour suffice to expand all alveoli with fluid. Another finding of interest in this connection has been described in the preceding section. It was seen that a given amount of air enters the smallest possible number of alveoli and fills these completely so that apparently no additional alveoli are aerated until sufficient air is aspirated to distend the open air spaces to the limit of their normal expansion. Fluid on the other hand may partially expand alveoli to various degrees.

The explanation suggests itself that surface tension counteracting the establishment of the very large area of contact between a fluid surface (that is, the moist alveolar wall), and air is responsible for this difference. Whatever air enters will tend to form the largest possible accumulation and thus the smallest possible surface. When air enters the collapsed alveolus this phenomenon assumes the well-known form of adhesion of moist surfaces which has been referred to by Wilson and Farber¹⁶ as one of the forces resisting aeration. On the other hand, surface tension will not resist the entrance of watery fluid into the alveoli in either large or small amounts. Similarly, if an alveolus is partly expanded with fluid, its resistance to aeration should, as far as surface tension is concerned, be just as great as if it were collapsed, because a phase boundary of the same kind must be established. It follows, therefore, that it should require much less force to expand alveoli with fluid than with air.

In order to test this hypothesis, the smallest necessary pressure was determined that is required to expand the nonaerated lungs of newborn or stillborn infants with fluid and with air. The method used is explained by a dia-

TABLE II. PRESSURE (IN CM. OF WATER) REQUIRED TO EXPAND ALVEOLI WITH SALINE OR AIR

AGE	INFANT		NUMBER OF MEASUREMENTS	AVERAGE FOR EXPANSION WITH	
	LENGTH	WEIGHT		SALINE	AIR
11 hours	38	990	2	10	24
45 min.	37.5	1120	3	12	21
24 hours	41	?	2	7	16
Stillborn	43	1820	3	3	13
Stillborn	43	2270	2	6	17
Stillborn	47.5	2220	3	5	15
Stillborn	49	2530	4	10	18
Stillborn	50	2700	2	15	21
Stillborn	50	2870	3	18	24
Stillborn	47	3110	2	9	15
Stillborn	52	3110	3	9	16
Stillborn	52	3220	2	10	18
Stillborn	50.5	3250	2	4	16
Stillborn	52.5	3700	1	11	18
Stillborn	54	3900	3	9	17
Average				9	18

gram (Fig. 8). The fluid was 0.85 per cent saline with a small amount of India ink added so that expanded areas could be easily seen by their dark color. The fluid was introduced by means of rubber tubing and a glass cannula inserted through the main bronchus into one of its branches. The bottle with the fluid was gradually raised until the black fluid appeared in the lung tissue. The difference in level between the surface of the fluid in the bottle and the specimen was recorded. In order to introduce air another bottle was inserted as shown in Fig. 8b. Air from that bottle entered the lungs under a pressure equal to the difference between the fluid levels in the two bottles.

Only small portions of the lung were expanded for each measurement so that up to four recordings for fluid and the same number for air could be obtained in one case by inserting the cannula into several bronchi. Lungs with extensive aeration or aspiration of amniotic sac contents were not used.

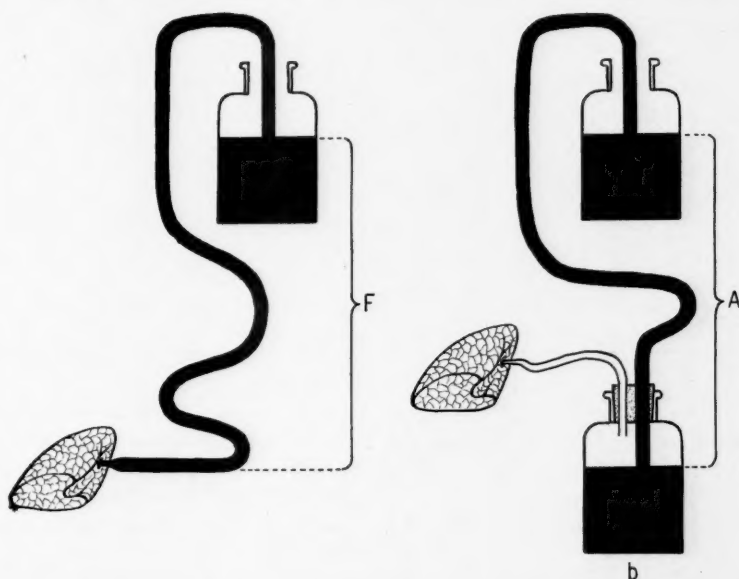


Fig. 8.—Diagram of the apparatus used for the determination of pressure necessary to inflate lungs (a) with fluid, or (b) with air. Fluid containing parts are shown solid black, air containing parts white with black outlines. (A) indicates the reading of air pressure, (F) that of pressure of fluid (both in cm. of fluid).

The results of these experiments are summarized in Table II. They show, in accordance with the hypothesis just advanced, that in every case a much greater pressure is necessary to introduce air than fluid. The average relation of pressure of fluid and air is 1:2; in the case with the smallest difference recorded it is 1:1.3; in the case with the greatest difference it is 1:4.3. All lungs were examined microscopically. As was described above, most of them had alveoli which were partially expanded with fluid, but, in accordance with the preceding discussion of surface tension, the amount of fluid present did not affect the result.

In order to demonstrate more directly the influence of surface tension on aeration, the experiment was modified in a group of six cases by the use of a surface active substance. If surface tension is the cause of the greater pressure required to fill alveoli with air, that pressure should be lowered if the tension were reduced by such a substance, e.g., amyl acetate. In the present experiments, amyl acetate was introduced into the lung by two methods. One

TABLE III. PRESSURE (IN CM. OF WATER) REQUIRED TO EXPAND ALVEOLI, SHOWING THE EFFECT OF A SURFACE ACTIVE SUBSTANCE, AMYL ACETATE (AA). EACH HORIZONTAL LINE REPRESENTS MEASUREMENTS IN ONE LOBE, TAKEN IN THE SAME ORDER AS SHOWN (FROM LEFT TO RIGHT)

INFANT			EXPANSION WITH					
AGE	LENGTH CM.	WEIGHT GRAMS	AIR	AIR WITH AA	SALINE	AIR AFTER SALINE	SALINE WITH AA	AIR AFTER SALINE WITH AA
18 hours	40	1220	21		8		9	16
			20	15 16				
Stillborn	44	1650	10		5	10	5	8
			10	7				
Stillborn	46	2740	17		10	16	10	13
			17	14 13				
16 hours	51	2100	18		10			
			17	15			10	14
Stillborn	51	2860	13		7		7	10
			13	9				
			11	9				
Stillborn	54.5	4360	15		5		5	10
			13					
				10 11				

consisted in the use of air with amyl acetate vapor from a bottle similar to the lower one in Fig. 8b, in which the surface of the water was covered with a layer of amyl acetate. In other tests saline saturated with amyl acetate (approximately 0.25 per cent) was introduced into the lung by an arrangement similar to that shown in Fig. 8a. The fluid was withdrawn again as far as possible by lowering the bottle below the level of the specimen, and exerting manual pressure on the lung. Pure air was then introduced into the same lobe. These experiments were preceded by determination of the pressure values for pure saline and air. The results are given in Table III.

There was a marked reduction in the pressure necessary to introduce air when amyl acetate was used by either of the two methods. The reduction amounts to nearly one-half the difference between the values for pure saline and air. This correlates well with the reduction of surface tension by amyl acetate, as shown roughly by the height of a fluid column in a capillary (33 mm. for saline, and 21 mm. for amyl acetate solution).

Another change was noted when amyl acetate was used. The aeration was more diffuse than usual, affecting larger portions of a lobe at the same time without immediately expanding them completely. In this respect, too, the condition was intermediate between normal aeration and expansion with saline. It is thus demonstrable that surface tension is a major factor in the resistance of the lung of the newborn to aeration but does not interfere with the aspiration of fluid.

Discussion

In the lungs of newborn infants three conditions must be distinguished, namely, true atelectasis, aspiration of fluid, and aeration. The first two can

usually not be distinguished by gross examination at autopsy. Many workers have classified all nonaerated lungs as atelectatic, without considering the possibility of aspiration of fluid. At microscopic examination these two conditions are easily differentiated, but, on the other hand, it is sometimes necessary to pay special attention to the distinction of alveoli expanded with fluid or with air. Only with these points in mind can the findings in the lungs of newborn infants be properly evaluated.

It is obvious that the amount of amniotic fluid present in the alveoli just after birth varies greatly. In general, liveborn infants show less aspirated fluid than do stillborn infants. Table I shows that true atelectasis is much more common in the former group (18 of 30 cases) than in the latter (2 of 30 cases). This suggests that atelectasis is the normal condition of the lungs before birth, as has also been found by some of the above mentioned workers in animal experiments. However, it was mentioned in the introduction that there is no clear-cut and compelling evidence to show whether or not the normal fetus and newborn infant has atelectatic lungs. It is conceivable, and compatible with the present observations in human autopsy material, that the fetus normally aspirates fluid which is then rapidly resorbed at birth so that atelectasis is secondarily established. Against this stands the observation of Farber and Wilson²⁸ which indicates that in initial atelectasis of the newborn the alveoli have a cuboidal lining which changes irreversibly into a flat lining when the alveoli expand for the first time. Moreover, one would expect to find much more vernix in the lungs of normal newborns than is actually the case if amniotic fluid had regularly been aspirated for a period of several months.

While no final decision is possible at this time, it is felt that the available evidence points more strongly toward the assumption of true atelectasis as the normal condition in the lungs of the fetus at birth. Yet, the presence of aspirated amniotic fluid at autopsy should not indiscriminately be considered as the cause of death. It may be fatal if the amount of fluid or its contamination with solid and fatty material is excessive. A summary of our own interpretation of the various stages in the expansion of the lungs with fluid and air is given in Fig. 1.

The aeration of lung tissue is resisted by surface tension which applies equally to atelectatic alveoli (adhesion of moist surfaces, Wilson and Farber¹⁶) and to air spaces which contain some fluid but are able to expand further. This resistance does not apply to the entrance of fluid, and that explains why fluid is aspirated so easily and extensively. One may wonder why episodes of anoxia which should occur occasionally during fetal life do not lead to severe aspiration in almost every case. The explanation is given by the fact that near the end of pregnancy the reserve of oxygen available for the fetus and with it the protection against anoxia increases rapidly. The oxygen saturation of the maternal blood returning from the placenta decreases very much during the latter part of pregnancy.²⁹ The same degree of anoxia of the mother which has a great effect on the fetus near term may not be harmful early in pregnancy because of the small consumption and greater reserve of oxygen.

In addition to other dangers of fetal anoxia, aspiration of amniotic sac contents should receive due consideration. It occurs with great ease, since it requires only about half the effort necessary for aeration. The importance of prevention of anoxia at or near term has been demonstrated by those who studied the effects of the nervous system,^{15, 27, 30, 31} and this must be strongly supported from the standpoint of lung pathology.

Summary

The stages in the fetal or neonatal expansion of the lung are described. If fluid is aspirated, all alveoli expand gradually and simultaneously. If air enters the lung, expansion proceeds by an increase in the number of aerated alveoli; each alveolus either remains collapsed or is fully expanded.

True atelectasis of all or part of the lung tissue is much more common in liveborn than in stillborn infants. This suggests that atelectasis is the normal condition of the fetal lung, and that expansion of the alveoli with fluid as seen in stillborns is the result of an episode of anoxia.

In order to determine the resistance of the lung tissue to expansion, the minimum pressure has been determined which is necessary to fill the alveoli with watery fluid or with air. In the lungs of 15 stillborn or newborn infants thus examined, the average pressure for air is twice that required for fluid. The greater ease with which fluid can be aspirated emphasizes the danger of fetal anoxia and the necessity of its prevention.

The resistance to aeration is due to surface tension which counteracts the entrance of air, but has no effect on the aspiration of fluid. Surface active substances reduce the pressure necessary for aeration. This suggests that the addition of surface active substances to the air or oxygen which is being spontaneously breathed in or introduced by a respirator might aid in relieving the initial atelectasis of newborn infants.

References

1. Beck, A. C.: *AM. J. OBST. & GYNEC.* 51: 173, 1946.
2. Farber, S., and Sweet, L. K.: *Am. J. Dis. Child.* 42: 1372, 1931.
3. Snyder, F. F., and Rosenfeld, M.: *J. A. M. A.* 108: 1946, 1937.
4. Snyder, F. F., and Rosenfeld, M.: *Proc. Soc. Exper. Biol. & Med.* 36: 45, 1937.
5. Bonar, B. E., Blumenfeld, C. M., and Fenning, C.: *Am. J. Dis. Child.* 55: 1, 1938.
6. Snyder, F. F., and Rosenfeld, M.: *AM. J. OBST. & GYNEC.* 36: 363, 1938.
7. Patterson, J. C., and Farr, J. T.: *Canad. M. A. J.* 41: 31, 1939.
8. Potter, E. L., and Bohlender, G. P.: *AM. J. OBST. & GYNEC.* 42: 14, 1941.
9. Reifferscheid, W., and Schmiemann, R.: *Centralbl. f. Gynäk.* 63: 146, 1939.
10. Ehrhardt, K.: *München. med. Wehnschr.* 86: 915, 1939.
11. Davis, M. E., and Potter, E. L.: *J. A. M. A.* 131: 1194, 1946.
12. Potter, E. L., and Adair, F. L.: *Fetal and Neonatal Death*, Chicago, 1940, University of Chicago Press.
13. Windle, W. F., Becker, R. F., Barth, E. E., and Schulz, M. D.: *Surg., Gynec. & Obst.* 69: 705, 1939.
14. Whitehead, W. H., Windle, W. F., and Becker, R. F.: *Anat. Rec.* 83: 255, 1942.
15. Windle, W. F.: *Harvey Lec.* 40: 236, 1945.
16. Wilson, J. L., and Farber, S.: *Am. J. Dis. Child.* 46: 590, 1933.
17. Holt, L. E., Jr., and McIntosh, R.: *Holt's Disease of Infancy and Childhood*, New York and London, 1940, D. Appleton-Century Co.

18. Förster, A.: *Virchows Arch.* **311**: 69, 1944.
19. Potter, E. L.: In a discussion of Zettelman, H. J.: See Ref. 20.
20. Zettelman, H. J.: *AM. J. OBST. & GYNEC.* **51**: 241, 1946.
21. Johnson, W. C., and Meyer, J. R.: *AM. J. OBST. & GYNEC.* **9**: 151, 1925.
22. Hook, H., and Katz, K.: *Virchows Arch.* **267**: 571, 1928.
23. Kaldor, J.: *AM. J. OBST. & GYNEC.* **25**: 113, 1933.
24. Rosenthal, M.: *J. Pediat.* **6**: 71, 1935.
25. Warwick, M.: *New York State J. Med.* **37**: 2075, 1937.
26. Benner, M. C.: *Arch. Path.* **29**: 455, 1940.
27. Clifford, S. H.: *J. Pediat.* **18**: 567, 1941.
28. Farber, S., and Wilson, J. L.: *Am. J. Dis. Child.* **46**: 572, 1933.
29. Barcroft, J., Flexner, L. B., Herkel, W., McCarthy, E. F., and McClurkin, I.: *J. Physiol.* **83**: 215, 1934.
30. Schreiber, F.: *J. A. M. A.* **111**: 1263, 1938.
31. Lamm, S. S.: *Am. J. Ment. Deficiency* **48**: 131, 1943.

ANALYSIS OF THERAPEUTIC ABORTIONS, BELLEVUE HOSPITAL 1935-1945

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THE occasional necessity for the interruption of a pregnancy, to preserve the life of a mother, has been recognized since ancient times,¹ and the difficulty of defining the borderline between such therapeutic procedures and criminal abortions has always existed. Neither the legal nor the medical professions have helped to clarify the issue,² since the former has failed to provide a clear statement of society's attitude, while the medical profession has failed to define the conditions which obligate a therapeutic abortion.

In our country, up to the present, each State has established its own legal policy, with a resultant body of law which is inadequate and often conflicting. The legal permission to execute a therapeutic abortion in New York State is contained in the legal code,³ but this does not describe the conditions to be met.

In 1934, at a symposium held before the Obstetrical, Gynecological, and General Surgical sections of the American Medical Association, the medical complications indicating therapeutic abortion were presented by several leading authorities.⁴⁻⁸ The suggested principles, which adequately expressed the modern viewpoint, were not accepted by other leading authorities at that time, nor has a greater unanimity been found in the recent literature. Analyses of therapeutic abortions from institutions in different sections of our country,⁹⁻¹¹ have shown a surprising agreement on most indications on the ratio of incidence to the number delivered and on the manner of interruption. Before the New York Obstetrical Society in 1944 a consideration of therapeutic abortion was given by S. A. Cosgrove,¹² which showed a distinct departure in the management of this problem.

Purpose and Scope

An analysis of the therapeutic abortions performed at Bellevue Hospital from June 1, 1935, to May 31, 1945, was undertaken in order to re-evaluate the policy for this institution. It was found that 199 pregnancies were interrupted on the gynecologic service; while, during the same period, 15,119 were delivered on the obstetric service. The incidence of therapeutic abortion was therefore 1.23 per cent, or this may be expressed as a ratio of one therapeutic abortion to every 76 women delivered.

The age, color, and marital status for the group are presented in Table I. There was no significant variation from the obstetric patients.

Source of Cases for Therapeutic Abortion

The source of admission was established in each case to determine the initiating request for interruption. From Table II, it can be seen that the department was responsible for 36 per cent of the cases, the several medical

TABLE I. VITAL STATISTICS

AGE		COLOR		MARITAL STATUS	
YEARS	INCIDENCE		INCIDENCE		INCIDENCE
15 and under	1.0	White	94.0	Married	78.3
16 to 20	5.7	Negro	5.0	Single	13.0
21 to 30	63.6	Others	1.0	Divorced	1.0
31 to 40	25.1			Separated	5.7
Over 40	4.6			Widowed	2.0

TABLE II. SOURCE OF ADMISSION

SOURCE OF ADMISSION	INCIDENCE (PER CENT)	OTHER SERVICE INVOLVED	INCIDENCE (PER CENT)
Direct	36.0	None	
By transfer (within hospital)	48.4		
		Tb	37.7
		Medicine	3.8
		Chest	1.1
		Cardiac	3.2
		Neur. & psych.	1.6
		Obstetrics	0.5
		Genito-urinary	0.5
			—
			48.4
Combined (by consult in O.P.D.)	15.6	Cardiac	4.9
		Tb	3.8
		Neur. & psych.	3.8
		Obstetrics	1.6
		Orthopedic	0.5
		Diabetic	0.5
		Radiation therapy	0.5
			—
			15.6

TABLE III. THERAPEUTIC ABORTIONS REFUSED

INDICATION	INCIDENCE	PROCEDURE NECESSARY		DELIVERED ON OBSTETRIC SERVICE
		CURETTAGE	HYSTEROTOMY	INCIDENCE
Tuberculosis				
Minimal	20.0	10.0	10.0	5.0
Moderately advanced	15.0	—	15.0	—
Far advanced	5.0	—	5.0	5.0
Cardiac				
Class I	5.0	—	5.0	—
Class II	15.0	10.0	5.0	5.0
Class III	5.0	5.0	—	5.0
Epilepsy	10.0	—	10.0	5.0
Hypertension and previous history of toxemia	5.0	—	5.0	—
Asthma	5.0	5.0	—	—
Hyperthyroid	10.0	—	10.0	5.0
Thromboeytic purpura	5.0	5.0	—	—
	100.0	35.0	65.0	30.0
				10% P.P. Sterilizations

services within the hospital for 48.4 per cent, and combined opinion for the remaining 15.6 per cent. The tuberculosis service accounted for most of the transfers within the hospital; more cardiac cases arose from the Out-Patient Department than were referred from within the hospital.

Therapeutic Abortions Refused

The final decision for termination was reached by the gynecologic service at all times, and the prerogative of refusal was exercised at least twenty times during the period covered by this report. These refusals are classified according to proposed indication in Table III. The reasons for refusal were about equally divided between insufficient medical evidence and a duration of pregnancy so late as to indicate equal risk to the mother for delivery at term, or for therapeutic abortion at that time.

Duration of Pregnancy and Parity

The duration of pregnancy and parity of the women in our series are presented in Table IV.

TABLE IV. DURATION OF PREGNANCY AND PARITY

DURATION OF PREGNANCY IN WEEKS	INCIDENCE	PARITY	INCIDENCE
0-4	1.5	None	26.8
5-8	40.0	I	21.4
9-12	43.0	II	21.4
13-16	14.0	III	8.6
17-20	1.0	IV	10.7
21-24	0.5	V	5.9
		VI	2.1
	100.0	VII	2.1
		VIII	0.5
		IX	0.5
			100.0

Therapeutic Abortions in Those Patients With No Living Children

It was found that 28.3 per cent of the women in this series had no living children. The therapeutic abortions performed on this group are presented in Table V. The indications vary from the entire group in that tuberculosis is greater by almost 16 per cent, in that cardiac disease and the toxemias of pregnancy were each less by 5 per cent, and the "other" indications were less by 6 per cent. The manner of termination varied in that the sterilizations were less frequent by 20 per cent than in the entire series, and in that there was a greater frequency of the dilatation and curettage operation. It is of interest to note the sterilizations among patients with neurologic and psychiatric complications occurred with slightly greater frequency in these women with no living children than in the group as a whole (71 to 63 per cent).

Indications for Therapeutic Abortion

The indications for therapeutic abortion have been under constant revision since this procedure was first introduced. The earliest indication⁴ noted in the literature of the eighteenth century was for contracted pelvis. In the middle of the next century, a gradually increasing scope was evolved which embraced indications for cardiac disease, tuberculosis, and many neurologic and psychiatric disorders. The use of therapeutic abortion continued to broaden until the

TABLE V. THERAPEUTIC ABORTIONS IN THOSE PATIENTS WITH NO LIVING CHILDREN

INDICATION	INCIDENCE		TYPE OF TERMINATION	INCI- DENCE
Tuberculosis	62.3		Dilatation and curettage	72.2
Minimal		11.3	Hysterotomy—abdominal	17.0
Moderately advanced		35.9	Hysterotomy—vaginal	1.9
Far advanced		15.1	Hysterotomy and sterili- zation	18.9
				100.0
Cardiac	11.3			
Class II		3.8		
Class III		5.6		
Class IV		1.9		
Toxemias	5.7			
Neurological and Psychiatric	13.2		STERILIZATIONS	INCI- DENCE
Psychosis		1.9	Tuberculosis	40.0
Epilepsy		7.5	Toxemia	10.0
Multiple sclerosis		3.8	Neurological and psycho- logical	50.0
				100.0
Others	7.5			
Arthritis		1.825		
Carcinoma right breast		1.825		
Diabetes		1.825		
Round-cell sarcoma		1.825		
	100.0	100.0		

turn of this century when the first evidence of conservatism became apparent and the medical profession took a more critical view of the indications.

A comparative analysis of the indications for therapeutic abortion from several leading hospitals is given in Table VI. From this, several points are noteworthy: (1) The period covered by the Johns Hopkins report, being much earlier than the others, shows the greatest frequency of interruptions. (2) The incidence at the Chicago Lying-in Hospital is the lowest of the standard type reported and shows greater emphasis on the toxemia indications. (3) The whole number and ratio of incidence for the Margaret Hague Maternity Center are not a matter of having fewer therapeutic abortions than any of the other services, but of being in an entirely different class. (4) The significant differences in New York Lying-in Hospital's report is in the incidence of toxemia

TABLE VI. COMPARISON OF INSTITUTIONS

THERAPEUTIC ABORTIONS	BELLEVUE	JOHNS HOPKINS ⁹	CHICAGO LYING-IN ¹⁰	MARGARET HAGUE ¹²	NEW YORK LYING-IN ¹¹
Number reported	199	287	134	4	280
Years covered	1935-1945	1896-1934	1931-1939	1931-1943	1932-1943
Ratio to number delivered	1:76	1:35	1:195	1:16750	1:167
Indications					
Tuberculosis	47	10	24	—	11
Cardiac	16	13	20	—	24
Neurological and psychological	13	17	15	—	6
Toxemias	10	46	28	100	35
Others	14	14	13	—	24
	100	100	100	100	100

and cardiac indications. (5) Bellevue Hospital's report is intermediate in frequency of occurrence, and shows many more interruptions for tuberculosis and many less for the toxemias of pregnancy than any of the other reports.

The individual analyses of the five major groups of indications at Bellevue follow.

1. *Tuberculosis*.—A most vehement controversy centers over tuberculosis as an indication for therapeutic abortion. There is no statement that can be made about this complication but that a diametrically opposite opinion can be quoted from an equally competent source. The high incidence at this hospital results from the large number of tuberculous hospital patients, and from the low socio-economic group we serve. As long as rest remains the essential of treatment, it is impossible for us to expect these people to support the ideal program of reduced activity that is necessary.

The tuberculous indications for interruptions are given in Table VII, showing the percentage occurrence of the pulmonary types, the average duration (in years and months) for each, the manner of terminations, and a five-year trend for all types. The occurrence in the earlier and later five-year periods show that tuberculosis accounts for 41.5 per cent of the total indications in the 1935 to 1940 period, while in the later span it rises to 56.8 per cent. This is partially explained on the regularity with which approximately 9.5 patients are aborted for tuberculosis each year. A different analysis is presented later showing the management of all phases of tuberculosis as far as it concerns the pregnant woman.

TABLE VII. TUBERCULOSIS

	MINIMAL	MOD. ADVANCED	FAR ADVANCED	UNCLASSIFIED
10 year incidence	15.8	56.9	16.8	10.5
1935 to 1940	10.6	25.9	8.4	5.25
Incidence				
1940 to 1945	5.2	31.0	8.4	5.25
Average duration	3 yr. 8 mo.	4 yr. 4 mo.	2 yr. 9 mo.	—
Termination—Type				
Dilatation and curettage	53.3	51.8	62.5	80.0
Hysterotomy	20.0	16.7	12.5	—
Hysterotomy and sterilization	26.7	31.5	25.0	20.0
	100.0	100.0	100.0	100.0
<i>Incidence of Tuberculosis Indication</i>				
Entire series			47.8	
1935-1940			41.5	
1940-1945			56.8	

2. *Cardiac Disease*.—The greatest unanimity of opinion has been evolved in the cardiac indications for therapeutic abortion. The functional classification is the first essential (the New York Heart Association has been used throughout), and the revelation of any history of failure is ominous. Any Class III cardiac showing decompensation, which does not respond to therapy, is to be considered for interruption. In Class IV cardiacs showing decompensation, the strictest attention toward therapy of the medical status is necessary before any procedure can be adopted. Patients with auricular fibrillation and with certain congenital cardiac malformations are considered a greater risk than others in the same functional class. These indications closely follow those previously reported by Pardee.⁵

The cardiac conditions which indicated therapeutic abortion are presented in Table VIII and are summarized as follows: (1) There were no interrup-

tions in Class I cardiac disease. (2) Class II cardiac indications were four and one-half times more frequent in the earlier five years covered in this report. (3) Class III cardiac indications comprised almost one-half of this group. (4) Of all these cardiac cases, 15 per cent were in failure during the gestation interrupted. (5) Stander¹³ reported a 2.55 per cent interruption incidence among his Class II and Class III pregnant cardiacs, as contrasted to a 0.2 per cent incidence for all pregnant cardiacs at this hospital.

TABLE VIII. CARDIAC

	CLASS I	CLASS II	CLASS III	CLASS IV	UNCLASSIFIED
10 YR. INCIDENCE	—	33.3	48.5	3.0	15.2
1935 to 1940	—	27.2	18.2	—	9.1
Incidence 1940 to 1945	—	6.1	30.3	3.0	6.1
Average duration in years	—	11.75	13.66	14.0	—
Termination—Type					
Dilatation and curettage	—	45.5	37.5	—	—
Hysterotomy	—	18.1	12.5	—	—
Hysterotomy and sterilization	—	36.4	50.0	100.0	100.0
		100.0	100.0	100.0	100.0
<i>Incidence of Cardiac Indication</i>					
Entire series				16.6	
1935-1940				16.1	
1940-1945				17.3	

3. *Neurology and Psychiatry.*—The trend in the evaluation of these disorders as an indication for therapeutic abortion has swung from comparative liberalism to marked conservatism in the past twenty years. There does not seem to be any one condition in neurology or psychiatry which absolutely indi-

TABLE IX. NEUROLOGY AND PSYCHIATRY

INDICATION	1935-1940 INCIDENCE	1940-1945 INCIDENCE	TOTAL	DILATATION AND CURETTAGE	HYSTER- OTOMY	STERILIZA- TION AND HYSTER- OTOMY
Epilepsy	8.3	12.6	20.9	20	—	80
Parkinson's disease	12.6	8.3	20.9	60	—	40
Multiple sclerosis	8.3	4.2	12.5	—	—	—
Psychoses	12.3	4.2	16.5	25	—	75
Residuals of poliomyelitis	8.3	—	8.3	50	—	50
Brain tumor	4.2	—	4.2	—	—	100
Amaurotic family idiotcy	4.2	—	4.2	—	—	100
Chorea and psychoses	4.2	—	4.2	—	—	100
Mental deficiency	4.2	—	4.2	—	—	100
Familial psychosis tendency	4.2	—	4.2	Not determined		
Total	70.9	29.1	100.0			

Incidence of Neurotic and Psychologic Indications

Entire series	12.0
1935-1940	14.4
1940-1945	8.6

cates interruption. The indications presented in Table IX show a pronounced diversity, but the repeated occurrence of the first four diseases in other reports⁸⁻¹⁰ indicates some uniformity of thought on certain disorders. The outstanding features in this group of therapeutic abortions are shown in the high incidence of sterilizations and in the markedly decreasing incidence of occurrence.

4. *Toxemias of Pregnancy and Pyelitis.*—The toxemias of pregnancy are in themselves on the decline in most parts of the United States because of the increased availability of antepartum care and the early treatment of the first signs of the disorder. Naturally, a fall in the incidence of therapeutic abortions for this indication has followed. Pyelitis of pregnancy has been placed with this group, since we felt that it more closely aligns itself to the toxemias of pregnancy than to any other group.

The analysis of the factors favoring interruption for the toxemias and for pyelitis (Table X) is only of limited significance, since many of these patients evidenced two or more factors at the time the therapeutic abortion was per-

TABLE X. TOXEMIAS OF PREGNANCY AND PYELITIS

TYPE	INCIDENCE	DILATATION AND CURETTAGE	HYSTEROTOMY	HYSTEROTOMY AND STERILIZATION
Hypertension	15.	66.6	—	33.3
Hyperemesis gravidarum	5.	100.0	—	—
Pre-eclampsia	5.	—	—	—
Previous history of toxemia	55.	54.5	9.1	36.4
Pyelitis	20.	75.0	—	25.0

Incidence of Toxemia and Pyelitis Indication

Entire series	10.1
1935-1940	9.3
1940-1945	11.1

TABLE XI. "OTHERS"

INDICATIONS	1935-1940 INCIDENCE	1940-1945 INCIDENCE	TOTAL	DILATATION AND CURETTAGE	HYSTER- OTOMY	STERILIZA- TION AND HYSTER- OTOMY
Diabetes	14.9	3.7	18.6	80	—	20
Ulcer	11.1	3.7	14.8	75	—	25
Neoplasms	14.8	—	14.8	100	—	—
Asthma	11.1	—	11.1	66.6	—	33.3
Bronchiectasis	3.7	3.7	7.4	50	—	50
Hyperthyroidism	7.4	—	7.4	100	—	—
Tuberculous familial diathesis	3.7	—	3.7	—	100	—
Arthritis	3.7	—	3.7	100	—	—
Congenital polycystic kidney	3.7	—	3.7	Not determined		
Marie-Strumpel's disease	3.7	—	3.7	100	—	—
Malnutrition	3.7	—	3.7	—	100	—
Gall bladder disease	—	3.7	3.7	100	—	—
Hemophilic heredity	—	3.7	3.7	—	—	100
Total	81.5	18.5	100.0			

Incidence of "Others" Indication

Entire series	13.5
1935-1940	18.7
1940-1945	6.2

formed. Any previous history of toxemia, when coupled with any of the others, weighed the evidence heavily toward interference.

5. "Others."—This group includes all of the remaining indications for therapeutic abortion. Each is a problem unto itself and requires the keenest individual evaluation. Several can be removed from the present-day indications for therapeutic abortion by recent advances in medical management. The decreasing incidence of this group of indications is the outstanding feature of Table XI.

Trends During the Ten-Year Period (1935-1945)

The summary of indications in Table XII presents the 1935-1940, 1940-1945 and the ten-year totals for all indications. A significant trend is noted between the earlier period when 59.3 per cent of the total were aborted—with a ratio of 1 to every 64.4 women delivered—as against only 40.7 per cent of the total for the later period—with a ratio of 1 to every 93 women delivered. This trend generally follows the conservatism which has become manifest in the indications for all therapeutic abortions. The relative trends within groups show an apparent increase in tuberculosis and an apparent unchanged incidence in the cardiac and toxemia-pyelitis indications. Further clarification is shown in a later analysis. The decreases in the other two groups are definite trends which account for the changes in the incidence for the two five-year periods.

TABLE XII. SUMMARY OF INDICATIONS

	1935-1940 TOTAL	1940-1945 TOTAL	10-YEAR TOTAL
Distribution	59.3	40.7	100.0
Indication			
Tuberculosis	41.5	56.8	47.8
Cardiac	16.1	17.3	16.6
Toxemias	9.3	11.1	10.1
Neurological and psychiatric	14.4	8.6	12.0
Others	18.7	6.2	13.5
	100.0	100.0	100.0
Number delivered	7602.0	7517.0	15119.
Therapeutic abortions	118.0	81.0	199.
Ratio	1:64.4	1:92.8	1:75.9

Note on Fetal Indications for Abortion

Two recent advances in the cause of fetal pathology suggest additional indications for therapeutic abortion. P. Levine¹⁴ has found it advisable to recommend interruption in six very carefully selected cases. The criteria are Rh-negative women already immunized from preceding pregnancies which had resulted in one or more erythroblastic infants with fatal forms of the disease, and whose husbands were such as to exclude the possibility of an Rh-negative infant. In the other instance, Albraugh¹⁵ has shown that a high incidence, and at times 100 per cent of the infants born to mothers who have had rubella in the early months of pregnancy, show severe congenital anomalies. The possibility to interrupt pregnancies for both the above conditions warrants serious consideration.

Repetition of Abortion in the Same Patient

A review of the past histories of these 199 women revealed that five therapeutic interruptions had been performed at other hospitals prior to their

Bellevue admissions. Among the 199 therapeutic abortions at Bellevue, eight were repeats on the same patients. This gives a gross repeat percentage of 6.5, of which 4 per cent occurred at this hospital. The indications of both therapeutic abortions were identical in each of these patients.

Technique of Interruption

The type of termination and the anesthesia preference are shown in Table XIII, according to the major groups of indication. The manner of termination was limited to operative procedures, in spite of the reported success of some observers with X-ray. The anesthesia department was consulted before any procedure was undertaken, and their preference followed.

TABLE XIII. MANNER OF TERMINATION

	TUBERCULOSIS	CARDIAC	NEUROLOGICAL AND PSYCHI- ATRIC	TOXEMIA	OTHERS
Curettage	57.0	33.3	30.5	60.0	75.1
Hysterotomy	14.7	9.2	—	—	7.7
Hysterectomy	—	3.0	4.3	5.0	3.8
Hysterectomy and sterilization	28.3	54.5	65.2	35.0	15.4
	100.0	100.0	100.0	100.0	100.0
ANESTHESIA PREFERENCE					
Cyclopropane	70.0	40.0	13.4	55.0	45.4
Gas-oxygen-ether	24.0	46.6	73.6	45.0	22.8
Gas-oxygen	—	10.0	8.7	—	22.8
Local	3.6	3.4	4.3	—	4.5
Spinal	1.2	—	—	—	—
Other	1.2	—	—	—	4.5
	100.0	100.0	100.0	100.0	100.0

Mortality

There was only one death among the entire series. This mortality rate of 0.5 per cent compares favorably with other reported rates. The history of the fatal case illustrates the error that can be made in the treatment of tuberculosis. A 19-year-old white girl was referred by the chest service for interruption, with a bilateral tuberculosis of six months' duration. A previous request for interruption by dilatation and curettage was refused because of the duration of the pregnancy. After considerable debate, in which the tuberculosis service considered interruption imperative to save the life of the girl, the hysterotomy was performed under spinal anesthesia. Death ensued on the sixth postoperative day from an extensive fibrocaseous, tuberculous, pneumonic consolidation of both lungs.

Therapeutic Abortions Versus Delivery

The ratio of therapeutic abortions to the number delivered has been given, but it is believed that this figure is of little value. A more valuable approach is a study of the number therapeutically aborted as compared to the number of deliveries accomplished in women suffering from the same medical complications. This is presented in Table XIV and affords an opportunity to study the end obstetric result.

TABLE XIV. COMPARISON OF THERAPEUTIC ABORTIONS PERFORMED TO THE NUMBER DELIVERED WITH THE SAME COMPLICATION

INCIDENCE PER 1,000 DELIVERED

	1935-1940		1940-1945		TOTAL OBSTETRIC	TOTAL THERA- PEUTIC ABORTIONS
	OBSTETRIC	THERA- PEUTIC ABORTION	OBSTETRIC	THERA- PEUTIC ABORTION		
Tuberculosis	10.0	6.5	14.6	6.1	12.3	6.3
Cardiacs	18.8	2.3	28.0	1.9	23.4	2.1
Toxemia						
Unclassified type	30.4		33.5		31.95	0.8
Hyperemesis	2.6		6.1		4.35	0.1
Pre-eclampsia	16.4		28.1		22.25	0.1
Eclampsia	1.5		2.4		1.95	—
Hypertension	21.3		23.9		22.60	0.3
Nephritis	0.9		0.9		0.9	—
	73.1	1.5	94.9	1.1	84.00	1.3

From the ten-year study of women delivered with and aborted for tuberculosis complicating pregnancy, the total incidence of the complication was found to be 18.6 per each 1,000 women delivered. Of these 18.6 women, 12.3 had been carried to term, and 6.3 had been therapeutically aborted. The trend in management, from a study of the 1935-1940 and 1940-1945 periods, revealed the number aborted for tuberculosis to have dropped by 6 per cent (6.5 to 6.1), while the number carried to term had risen by 32 per cent (10.0 to 14.6). This reveals then an increasing conservatism in the indication of tuberculosis for therapeutic abortion when one considers the over-all management to be given the pregnant, tuberculous woman. This study negates the erroneous impression of an increasing incidence of tuberculosis as an indication for therapeutic abortion obtained from a study of indications only.

In a similar study of cardiac disease in pregnancy, the total incidence was 25.5 per 1,000 women delivered, of whom 23.4 were carried to delivery, and of whom 2.1 required interruption. In a study of the management of the pregnant cardiac, the five-year analyses revealed a decrease of 15 per cent in the number aborted for cardiac disease (2.3 to 1.9), while the number carried to delivery rose by 33 per cent (18.8 to 28.0). This again shows a decreasing incidence in the employment of therapeutic abortion as a measure in the management of the pregnant cardiac patient, as against a fixed incidence suggested by a study of indications only.

A like study of the toxemias of pregnancy revealed a total incidence of 85.3 per 1,000 delivered, of whom all but 1.3 can expect to carry to term. The trend study revealed a decided drop of 26 per cent in the number aborted for the toxemias of pregnancy (1.5 to 1.1), coupled with a 23 per cent rise in the number delivered with the same complication (73.1 to 94.9). This again dispels the impression of a fixed occurrence incidence suggested by a study of the indications.

Maternal Mortality

A study of maternal mortality which concerns therapeutic abortion is presented in Table XV. For the 1935-1945 period studied, the total maternal mortality was 2.8/1,000, of which 0.7/1,000, or one-fourth, of these deaths resulted from medical complications for which therapeutic abortions have been performed. This proposes that, despite the current enthusiasm for conservatism, the ideal in management is yet to be reached.

TABLE XV. 10-YEAR MATERNAL DEATH RATE

All causes	2.8 /1000
Tuberculosis (Far advanced)	0.14/1000
Cardiac	0.07/1000
Psychosis	0.07/1000
Toxemias	0.21/1000
Toxemia and psychosis	0.07/1000
Carcinoma	0.14/1000
Total	0.70/1000

Summary and Conclusions

1. A series of 199 consecutive therapeutic abortions performed at Bellevue Hospital from June 1, 1935, to May 31, 1945, has been reviewed.

2. Tuberculosis was the major indication for therapeutic abortion at this hospital, accounting for 47.8 per cent of the cases.

3. A lesser incidence of interruption for the toxemias of pregnancy (10.1 per cent) was found in this series than has been reported elsewhere.

4. From a comparison of the number of therapeutic abortions performed to the number delivered with the same medical complication, it was found that the indications for all therapeutic abortions are on the decrease, whereas the number delivered with the same medical complication is on the increase.

5. From all evidence in this study, the policy in effect at Bellevue Hospital from 1935 to 1945 has been justified. Its continuation in the future is warranted until additional scientific data justify modification or change.

The author wishes to express his indebtedness to Dr. Howard C. Taylor, Jr., for his invaluable guidance and cooperation in the preparation of this paper.

References

1. Taussig, Frederick J.: Abortion, Spontaneous and Induced, Medical and Social Aspects, St. Louis, 1936, The C. V. Mosby Co.
2. The Abortion Problem, Baltimore, 1944, Williams and Wilkins Company.
3. New York Penal Code, Section 80.
4. Pottenger, F. M.: J. A. M. A. 103: 1907, 1934.
5. Pardee, H. E. B.: J. A. M. A. 103: 1899, 1934.
6. Cheney, C. O.: J. A. M. A. 103: 1914, 1934.
7. Herrick, W. W.: J. A. M. A. 103: 1902, 1934.
8. Wagener, H. P.: J. A. M. A. 103: 1910, 1934.
9. Peckman, C. H.: Surg., Gynec. & Obst. 63: 109, 1936.
10. Hesseltine, H. et al.: AM. J. OBST. & GYNEC. 39: 549, 1940.
11. Kuder, K., and Finn, W. F.: AM. J. OBST. & GYNEC. 49: 762, 1945.
12. Cosgrove, S. A., and Carter, P. A.: AM. J. OBST. & GYNEC. 48: 229, 1944.
13. Stander, H. J.: AM. J. OBST. & GYNEC. 36: 413, 1938.
14. Levine, P.: Personal Communication.
15. Albraugh, C. H.: J. A. M. A. 129: 719, 1945.

20 HILLSIDE AVENUE

LATE POSTPARTUM BLEEDING: A METHOD OF PREVENTION

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EVERY year at least six patients have been readmitted to the Elizabeth Steel Magee Hospital on account of excessive bleeding, occurring from thirteen to forty-two days following delivery. All have needed dilatation, curettage, and packing of the uterus. Some have required plasma or blood transfusions, and their average hospital stay has been 8.4 days. Besides these actual hospital admissions, there have been countless telephone calls and numerous house visits necessitated by mild to moderate persistent postpartum bleeding. The time, expense, annoyance, and potential hazard involved add up to a considerable problem. Is there some method by which this complication, nuisance, and even potential threat to the patient's life can safely be avoided—thus saving time, money, hospital beds, and annoyance both to the patient and the obstetrician? We feel that if obstetric patients are carefully observed and treated following delivery this complication need not remain unrecognized and uncorrected.

A lochia rubra which persists for more than six or seven days post partum is abnormal and may be dangerous. The principal causes are retained secundines with subinvolution of the uterus and, as demonstrated by Rutherford and Hertig,¹ failure of involution of the placental site itself without retention of placental tissue and possibly without subinvolution. How can we confirm one or the other diagnosis, and what treatment is feasible and safe?

Before answering this, let us review our routine management of the third stage of labor. At the end of the second stage, an ampule of pitocin is given subcutaneously. The episiotomy is then repaired. We do not massage the uterus until placental separation has occurred, unless hemorrhage necessitates interference. When upward pressure on the anterior uterine wall above the symphysis does not cause the cord to be drawn into the vagina the placenta is free. After light massage to make the uterus firm, the placenta is expressed and is closely examined for deficiencies. If none are found an ampule of ergonovine is given subcutaneously or intravenously, following which a course of $\frac{1}{320}$ grain of ergonovine, three times a day for three days, is ordered. Despite such conservative handling of the third stage of labor, retention of small pieces of placenta cannot be prevented in all cases, because small defects in the placenta cannot always be detected even by careful examination.

If placental tissue is retained, or if there is subinvolution of the placental site, the characteristic clinical signs during the postpartum hospital period are:

*Presented before the Pittsburgh Obstetrical and Gynecological Society, Nov. 4, 1946.

1. Lochia rubra persisting beyond the sixth or seventh day.
2. Subinvolution of the uterus.
3. A persistent low-grade temperature of 99° to 100° F., or even slightly higher in the majority of cases.

As treatment, we have tried a second or even a third course of ergonovine together with a sulfonamide; but uniformly satisfactory results have not been attained. Our subsequent approach is more active than passive. According to the latter school retained placental tissue, unless hemorrhage necessitates interference, should be left alone, in the hope that it will eventually slough out. We employ the following routine: if by the eighth or ninth postpartum day lochia rubra persists, unless the temperature is definitely septic in character, a pelvic examination is made in bed. The labia are widely separated and, using a sterile glove, two fingers are introduced into the vagina, keeping as close as possible to the symphysis so that the episiotomy is not broken down. The uterus is usually found to be anteflexed and the cervix patulous. With the outside hand, the axis of the uterus is straightened, and the second finger is introduced through the open cervix. The fundus is then pushed down so that the examining finger can explore the entire cavity. In practically all cases a piece of tissue or a marked elevation on the uterine wall can be felt. With this confirmation, and unless there is a marked reaction to the pelvic examination, the patient is taken to the operating room the next day. Under anesthesia, a placental forceps is introduced into the uterus, the tissue is grasped and removed with a twisting motion, and the uterine cavity is then packed. Recently we have also been giving penicillin prophylactically for forty-eight hours. Following the removal of the packing in twenty-four hours, the temperature usually drops to normal and the patient is, in most instances, discharged on the fifth postoperative day. If on initial examination no placental tissue is felt, a course of ergonovine usually gives satisfactory results.

Before presenting our statistics, two typical case histories will be given and characteristic temperature charts shown. Mrs. C. M., gravida i, at term, was delivered spontaneously after a labor of a twelve-hour first stage, thirty-five-minute second stage, and twenty-five-minute third stage. The placenta separated by the Schultze mechanism and on inspection was considered intact. The postpartum course was febrile, with the temperature varying between 99° F. and 102.2° F. On the eighth day post partum the fundus was three fingerbreadths above the symphysis, there was persistent lochia rubra, the temperature was 100.4° F., and on vaginal examination a piece of placental tissue was felt in the fundus. A mild febrile reaction following examination deferred operation until the eleventh day, at which time, under sodium pentothal anesthesia, placental forceps were used to remove the retained tissue, and the uterine cavity was packed. Twenty-four hours later the packing was removed, the temperature dropped to normal, and the patient was discharged on the seventeenth postpartum day.

Mrs. K. P., gravida iii, estimated date of confinement July 12, 1940, came into the hospital July 15 in active labor. After an inertial labor of a seventy-three-hour and twenty-minute first stage, a sixteen-minute second stage, and a

nine-minute third stage, she was delivered spontaneously of a living $8\frac{3}{4}$ pound male infant. The placenta was expelled by the Duncan mechanism, and was considered intact. The temperature varied between 99° F. and 100° F. post partum, and there was persistent lochia rubra. Pelvic examination on the ninth postpartum day revealed a subinvolved uterus with placental tissue on the anterior wall. Dilatation, evacuation, and packing were done on the eleventh day. Twenty-four hours later the packing was removed, the temperature dropped to normal, and four days from the time of operation the patient was discharged.

From Jan. 1, 1938, to Jan. 1, 1946, we performed 134 postpartum evacuations and packings on 85 private and 49 ward patients. All patients were estimated to be of at least seven months' gestation, and 119 were delivered at term. Ages varied from 14 to 40 years. Fifty-seven were primigravidas, 37 secundigravidas, 19 tertiagravidas, and 21 of greater gravidity. The total length of labor varied from one hour and thirty-six minutes to seventy-three hours and forty-five minutes, and the third stage from three to ninety minutes, with an average of thirteen minutes. The placenta separated by the Schultze mechanism in 87 cases, Duncan in 34 cases, and was manually removed in 13 instances. The placenta was reported as questionably incomplete in only seven instances. Of these the placenta separated by the Duncan mechanism five times, and was manually removed twice. The postpartum temperature prior to operation was afebrile in 35 cases, Zone 1* in 73 cases, and Zone 2† in 26 cases. Evacuation and packing were performed on the fifth to the eighteenth day post partum, usually on the tenth or eleventh day. Following operation the temperature was afebrile in 89 instances, and Zone 1* in 37 instances. Elevation persisted for but two days in 22 of the patients, and three days in 9 cases. Eight operations were followed by a Zone 2† temperature. Three of these patients were in Zone 2† for but two days, and in one of these a Bartholin cyst was removed at the time of evacuation and packing. Two had elevated temperature for five days, one of these reached Zone 2† prior to operation. The other had endometritis, severe anemia, and hemorrhage, necessitating evacuation and packing of the uterus on the thirteenth day. The sixth patient was febrile for seven days. She had been delivered of twins and developed a septic temperature further complicated by profuse bleeding on the sixth day. The remaining two patients bled excessively. One required hysterectomy several hours after evacuation and packing. Both needed transfusions of blood and/or plasma. These patients were in the hospital twenty-eight and seventeen days, respectively, following operation.

The average hospital stay of the 134 patients was 17.9 days. Deliveries were: spontaneous, 48; low forceps, 61; midforceps, 6; version and extractions, 10; and breech extractions, 6. There were three sets of twins, four stillborn infants, of which two were macerated, and two neonatal deaths. It seems, therefore, that age, multiparity, length of labor, particularly of the third stage, method of delivery, mechanism of separation of the placenta, multiple pregnancy

*Zone 1.—Temperature above 99° F. and below 100.4° F. for any two consecutive twenty-four-hour periods, exclusive of the first twenty-four hours.

†Zone 2.—Temperature of 100.4° F. or above for any two consecutive twenty-four-hour periods, exclusive of the first twenty-four hours.

or viability of the child, are not important factors as regards the occurrence of late postpartum bleeding.

The pathologic report on the tissue removed was degenerating decidua-like tissue, degenerating placenta, chronic metritis, chronic interstitial endometritis, or necrotic debris. The fact that true degenerating placenta was found by the pathologist in only 10 instances lends support to Rutherford and Hertig's concept that one of the important causes of late postpartum bleeding is failure of involution of the placental site itself without retention of placental tissue.

Discussion

Because we feel this problem of continued postpartum bleeding sufficiently important, we have dared to violate orthodox concepts. When the lochia rubra persists more than six or seven days, more can be learned than risked by vaginal examination. There is also definite evidence that the open uterine wound is sealed off in approximately five days, and the mucosal surface is well on the road to complete regeneration. Furthermore, a vaginal examination is of prognostic value in that it serves as a deterrent for further manipulation if it produces a marked febrile reaction.

Whether or not evacuation and packing of the uterus in the relatively early puerperium are safe must be decided on the basis of results. However, if dilatation and curettage for retained secundines are performed almost routinely following abortions, as is recommended by DeLee, why should not evacuation be performed in the puerperium when there is known retained tissue? With the availability of penicillin for prophylactic or curative use, we feel we are on even safer ground.

The criticism that the amount of tissue evacuated is often very small can only be answered by the smooth and rapid convalescence which has followed its removal. On the other hand, is it not possible that the removal of infected tissue may prevent trouble in future pregnancies? We recall one patient who refused operation following diagnosis of retained tissue. Despite a persistent bloody discharge she became pregnant before many months, and terminated her pregnancy with a partial placenta previa. Whether there was any connection in this case can only be surmised. What we do know is that we have had no further trouble with any patient treated according to our routine.

Conclusions

1. Despite conservative handling of the third stage of labor and careful examination of the placenta, the occasional retention of small pieces of placental tissue cannot be prevented or even detected at delivery.
2. Subinvolution of the placental site without retention of placental tissue is often a definite cause of postpartum bleeding.
3. Lochia rubra persisting beyond the seventh day, subinvolution of the uterus, and low grade temperature usually indicate retained placental or infected decidua tissue.

4. Vaginal examination of patients with characteristic symptoms about the eighth or ninth postpartum day will demonstrate the presence of retained tissue or marked subinvolution of the placental site.

5. We advocate removal of such tissue a day or two later under anesthesia employing placental forceps, followed by packing of the uterus.

6. Results of a series of 85 private and 49 ward patients are presented.

7. We believe this procedure lessens the period of morbidity, eliminates a potential danger to the patient, obviates untold annoyance to both patient and physician, shortens hospitalization, and returns the uterus to a healthy status for future pregnancies.

Reference

1. Rutherford, R. N., and Hertig, A. T.: AM. J. OBST. & GYN. 49: 378, 1945.

A STATISTICAL STUDY OF THE CASES OF PLACENTA PREVIA OCCURRING IN THE JEWISH HOSPITAL FROM 1935 TO 1946

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IN RECENT years our management and results in cases of placenta previa have been so markedly different than in the past, that we considered it worth while to present a brief report on the subject. There has been a marked reduction in maternal mortality and an appreciable reduction in fetal mortality. These seem to be directly related to the high incidence of cesarean section and the frequent use of blood transfusions. In the past, section was resorted to in only a few selected cases and blood was given only when the blood loss was very severe. In the group of cases to be presented here, section was done in 60 per cent of all the cases, while transfusions were used very freely regardless of whether the case was treated by simple rupture of the membranes or by cesarean section. Our own experience and a study of the literature have convinced us that the replacement of blood lost in cases of previa is of crucial importance.

From January 1, 1935, to July 1, 1946, there were 37,688 deliveries in this service. Among these were 165 cases of placenta previa; an incidence of 1:228, or 0.43 per cent. There were 61 (37 per cent) primiparas, and 104 (63 per cent) multiparas. The youngest patient was 19 years, the oldest 40 years.

Previous bleeding, varying from slight staining to recurrent moderate bleeding was recorded in 64 cases. Of these 64 patients, 17 had been hospitalized once or more during the pregnancy. Membranes were intact in 149 cases, and ruptured in 16. Nine patients were admitted in labor and in 5 cases symptoms of previa did not present themselves until after the onset of labor. The varieties of previa were distributed as follows: central, 37; partial, or lateral, 73; marginal, 43. In 12 instances the degree of previa was not recorded. Of the 165 cases studied, 160 were admitted in good condition, 4 in fair condition, and only one in very poor condition.

Management

Of 165 cases, 97 were handled by abdominal cesarean section, one by vaginal cesarean (vaginal hysterotomy), and 67 by the vaginal route. Forty-three patients were given transfusions, ranging from 500 to 3,400 c.c. of blood. In all, 60 transfusions were given.

The cases handled vaginally were treated as follows:

Vaginal Hysterectomy	1 case
Nothing, or Rupture of Membranes	21 cases
Other Vaginal Methods	46 cases
(Bag alone, bag and version, or version-extraction)	

Fetal Mortality:

Babies alive and discharged	124 (74.2%)
*Stillborn	17 (10.1%)
*Neonatal Deaths	26 (15.5%)
	167 (2 sets of twins)

TABLE I. MANAGEMENT AND FETAL RESULTS

NOTHING OR RUPTURE OF MEMBRANES 21 CASES (12.7%)	OTHER VAGINAL METHODS (BAG, VERSION, ETC.) 46 CASES (27.8%)	SECTIONS 98 CASES (59.3%)
Babies > 5 lbs. alive 12 (57.1%)	Babies > 5 lbs. alive 12 (26.1%)	Babies > 5 lbs. alive 77 (78.5%)
< 5 lbs. alive 6 (28.5%)	< 5 lbs. alive 5 (10.9%)	< 5 lbs. alive 10 (10.2%)
> 5 lbs. stillbirth or neo- natal death 0	> 5 lbs. stillbirth or neonatal death 9 (19.6%)	> 5 lbs. stillbirth or neo- natal death 2 (2.0%)
< 5 lbs. stillbirth or neo- natal death 3 (14.2%)	< 5 lbs. stillbirth or neonatal death 20 (43.5%)	< 5 lbs. stillbirth or neo- natal death 9 (9.1%)

Table I gives at a glance the method of management and the fetal results. This table illustrates rather strikingly that the best fetal results are obtained when either a very simple vaginal procedure, such as rupture of the membranes, is done, or when a section is done. In the first group, the fetal salvage is over 85 per cent; in the section group it is over 88 per cent. The highest fetal mortality is found in the group handled by either bag, bag and version, or version-extraction. In this latter group, the fetal survival rate is only 37 per cent. While it is true that this multiple procedure group has in it the highest number of babies under 5 pounds and this is partly responsible for the high fetal loss, it is only partially so; in the same group, the babies of 5 or more pounds have a survival rate of only 45.7 per cent. From this it is obvious that the multiple procedure method of handling placenta previa through the vagina is the important factor in giving the high fetal mortality.

Maternal Results

There was only one maternal death in this group of 165 cases.

CASE REPORT.—Patient was a 39-year-old gravida vii, para iv, 32 weeks pregnant. Was admitted in 1937 with history of bleeding on and off for one month. A vaginal examination was done on the second day after admission when bleeding recurred. No placental tissue was felt at this time. A second vaginal done at a later time showed a marginal placenta previa. Upon further bleeding, a third vaginal was done and central placenta previa was diagnosed. Membranes were ruptured and a bag inserted through the placenta. Bag expelled 49 hours later and a hand and cord prolapsed; temperature at this time was 103°, pulse 130. A version was done and spontaneous delivery followed 10 minutes later. Patient died of sepsis on the 12th day after delivery. A positive blood culture for streptococcus viridans was obtained during the illness. Patient also had a toxic anuria with a urea nitrogen of 153. She received sulfanilamide; 300 c.c. of blood on the 9th day and 500 c.c. on the 10th day.

*Thirteen were 28 weeks or less.

Morbidity

Of the 21 cases treated by simple rupture of membranes, 3 were morbid, or 14.2 per cent. Average number of days of morbidity was two.

Of the 46 cases handled by more complicated forms of vaginal delivery, 14 or 30.4 per cent were morbid. Average number of days of morbidity was 3.8.

Of the abdominal sections, 66 were classicals, 30 were low-flap, one was a Waters. Fifty-one of the 97 cases, or 52.6 per cent were morbid. Average number of days of morbidity was 4.1. There was no appreciable difference in morbidity between the classical and low-flap sections.

In 1936, Ronsheim reported 283 cases of placenta previa treated at our hospital from 1907 to 1935. The important statistical comparisons between this series and the one reported here are brought out in Table II.

TABLE II.

	MANAGEMENT			MATERNAL MORTALITY	FETAL MORTALITY
	GROUP I	GROUP II	GROUP III		
Ronsheim's Series 283	23.3%	65.7%	11.0%	5.3%	46.3% (stillbirths only)
Present Series 165	12.7%	27.8%	59.3%	0.6%	25.8%

In his paper, Ronsheim advocated termination of the pregnancy with the first episode of serious bleeding, and concluded that the bag was the ideal method of treatment. Both of these ideas are refuted by the more recent literature, as well as by our own results in the group of cases reported here.

Watson and Gusberg, in 1943, reported a small series of cases and concluded that the use of Voorhees' bag was dangerous and inefficient in the treatment of placenta previa. These authors felt that the only two efficient methods of treatment were rupture of the membranes and cesarean section.

Williamson and Greely, in 1945, reported 162 cases and were of the opinion that the best results from vaginal delivery were obtained in those cases in which the bleeding could be controlled by simple rupture of the membranes. Otherwise, cesarean section seemed to be the management of choice.

Yepes and Eastman, in 1946, conclude that abdominal delivery should be employed in all cases of this complication with the exception of marginal types in multiparae with vertex presentations.

Our own results, with the markedly improved fetal and maternal mortality, would lead us to agree with the conclusions of the above three groups of authors.

Heretofore there has been general agreement with Ronsheim's statement that the uterus should be emptied with the first episode of vaginal bleeding. More recently, MacAfee and Johnson, working independently, have advocated a waiting policy in many cases of placenta previa because they felt it would improve the fetal prognosis. Both papers contend that hemorrhage in placenta previa is rarely, if ever, fatal in the absence of vaginal manipulation; therefore they advocate a waiting policy with the hope of getting better fetal results. This is particularly true for those cases that are not yet viable. Eastman, in checking 304 cases of placenta previa, found no instance of fatal hemorrhage in the absence of vaginal manipulation. Eastman then concludes that a patient with placenta previa with a non-viable or questionably viable baby, can often be safely carried to viability, provided she is in a well-equipped hospital and under expert care.

Discussion

Most textbooks on obstetrics agree that the management depends upon the type of previa, the parity of the patient, the condition of the cervix and whether or not the patient is in labor. The type of previa is often difficult to determine accurately because it depends upon the amount of cervical dilatation. Theoretically it is impossible to determine the exact degree of previa until full or almost full dilatation has occurred. For this reason, most statistical tabulations, including our own, as to the type of placenta previa, are unreliable. All agree that central previa, in primiparas or multiparas should, with almost no exceptions, be handled by section. Some go further and state that all previas in primiparas, except the marginal variety, should be handled by section.

Some few observers advocate the use of the bag, but this is often followed by other operative vaginal procedures with the attendant dangers of laceration, hemorrhage and infection. The recent literature and our own results prejudice us against the use of the bag.

All agree, however, that blood should be used freely to replace blood loss regardless of the variety of previa, the parity of the patient or the method of management. Forty-three of our patients were given transfusions, from 500 to 3,400 c.c. In all, 60 transfusions were given. In recent years, all patients were given Rh negative blood. Most observers advise a gentle vaginal examination to be certain of the diagnosis, while some few are against it. We feel that in the vast majority of cases, a gentle vaginal done under strict aseptic precautions, with the operating room ready for possible section, can and should be done. In our series of 165 cases, 98 had vaginal examinations while 67 did not.

The time to terminate the pregnancy in cases of placenta previa is still a moot point. Until recently, the teaching by most authorities has been that the uterus should be emptied as soon as a diagnosis of placenta previa was made. The recent papers by Johnson of Texas and MacAfee of Belfast, Ireland, and the comments upon them by Eastman, seem to indicate that it is probably safe to temporize in some of the nonviable or near viable cases provided they are under good care in a well-equipped institution where they can be watched closely and blood loss can easily be replaced. This should bring about considerable improvement in the fetal mortality.

Our results in the group of cases herein presented have convinced us that the best results follow either simple rupture of the membranes or cesarean section. Practically the same conclusions were reached by Watson and Gusberg; Yepes and Eastman; and Williamson and Greely.

Conclusions

1. We have presented a brief review of 165 cases of placenta previa with a fetal mortality of 25.8 per cent and a maternal mortality of 0.6 per cent.

2. This group of cases is compared with a previous series of 283 cases reported from our hospital 10 years ago with a fetal mortality of 46.3 per cent and a maternal mortality of 5.3 per cent.

3. The reasons for the marked improvement in fetal and maternal mortality, we believe to be the greater number of cases that were handled by either simple rupture of the membranes or cesarean section, and also to the more frequent use of blood transfusions.

4. The hydrostatic bag, or the bag followed by other vaginal manipulations, is not a good method for treating placenta previa. We predict that it will eventually be discarded completely.

5. The suggestions of Johnson and MacAfee to temporize in certain cases of placenta previa is worthy of trial. It should lower the fetal mortality.

References

1. Ronsheim, J.: AM. J. OBST. & GYNEC. 32: 139, 1936.
2. Watson, B. P., and Gusberg, S. B.: AM. J. OBST. & GYNEC. 46: 524, 1943.
3. Williamson, H. C., and Greely, A. V.: AM. J. OBST. & GYNEC. 50: 398, 1945.
4. MacAfee, C. H. G.: J. Obst. & Gynaec. British Empire 52: 4, 1945.
5. Johnson, H. W.: AM. J. OBST. & GYNEC. 50: 248, 1945.
6. Yepes, L. G., and Eastman, N. J.: South. Med. J. 39: 291, 1946.
7. Eastman, N. J.: Obst. and Gynec. Survey 1: 53, 1946.

THE EFFECT OF DIPHTHERIA ON PREGNANCY, WITH A REPORT OF FIVE CASES

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THE occurrence of diphtheria during pregnancy or the puerperium is rare, as evidenced by the paucity of reports in the literature. There is a two-fold explanation for this. First, diphtheria is primarily a disease of the first decade of life; and second, the general practice of active immunization has resulted in a decreasing incidence of this disease during the present century. Recently, however, for reasons not yet clear, there has been an increase in the incidence of adult diphtheria. Thus, during the past year four patients with antenatal diphtheria have been observed. These women, with a fifth patient who was delivered in the Johns Hopkins Hospital in 1907, comprise the cases reported in this paper and represent the total number of patients with diphtheria in pregnancy seen in the Obstetrical Clinic in the past fifty years, during which time more than 50,000 deliveries occurred.

Contemporary obstetric textbooks have little to say concerning the occurrence of diphtheria in pregnancy and, in general, reflect opinions current in the older French and German literature. The most detailed coverage of the subject appears in Halban and Seitz.

The clinical and pathologic changes of diphtheria are well known. The localized lesions found in the female genital tract are less familiar. These latter constitute in a large measure a puerperal disease and are usually secondary to nasopharyngeal contamination, though primary diphtheria of the vagina may occur through cross infection where the bacilli may be carried from one patient to the other. Bumm, in 1895, first described the familiar adherent gray membrane in the vagina from which a pure culture of Klebs-Löffler bacilli was obtained. In 1898 Williams reported a case from this hospital involving the vulva. No other instance of localized diphtheria in the female genital tract has been seen in this Clinic during the present century. Sporadic reports have, however, appeared throughout the years. All agree that the disease generally appears in the puerperium, and is usually mild and responds readily to antitoxin therapy. It is, however, possible to have systemic involvement with paralysis in neglected cases. Local penetration of the uterus with spread to adjacent structures is practically nonexistent. In 1928, LeFevre reported an authentic case of diphtheritic endometritis following criminal abortion. LeFevre also reviewed at this time three other possible cases found in the literature. Investigations to determine the importance of the vagina as a carrier site for virulent bacilli have resulted in conflicting results. Wauschkuhn, routinely culturing the vagina of 200 pregnant women, discovered the diphtheria bacilli in 11 women. Four of these 11 women gave birth to infants with nasal diphtheria. Lietz found an even higher incidence. Broer claimed that 7 of 30 women examined in the Mainz area harbored the

Klebs-Löffler bacillus in the vagina. Doubt was cast on these findings by Lonne and Meyeringh, who were unable to demonstrate the bacilli in a single case in a series of 42 women. Suspicious organisms were found which, on closer examination, turned out to be pseudodiphtheria bacilli. Stander, in his text, states that he has never been successful in confirming Wauschkuhn's findings.

There is little in the literature regarding the effect of pregnancy on the course of diphtheria. Canéva, in 1852, described five cases of croup, three occurring in pregnant women. He commented on the rarity of laryngeal diphtheria in the adult, and felt that pregnancy was conducive to this form of the disease. Ollier, in 1904, stated that pregnancy did not predispose to or aggravate diphtheria. Labor was also innocuous. Berkeley, Bonney, and MacLeod state that pregnancy accentuates diphtheria, causes more laryngeal involvement, and results in a high maternal mortality rate in the absence of antitoxin therapy. Recently Kennedy described a case of laryngeal diphtheria in a pregnant woman. Most of the textbooks state that severe diphtheria results in abortion or premature labor, and Priestley stated that diphtheria was inimical to pregnancy. Ollier felt that untreated cases resulted in abortion, but the use of antiserum produced a significant decrease in the abortion rate. Döderlein was of the opinion that the toxin was responsible for abortion. Halban and Seitz cite an abortion rate of 33 per cent, which they feel is attributable to the effects of the toxin and anoxia. DeLee and Greenhill also quote a 33 per cent abortion rate and indict the toxins of the disease and respiratory disturbances. The source reference for this high abortion rate appears to be Anderodias who (quoting Halban) arrived at this figure through clinical observation and then confirmed it by injecting toxin intradermally into pregnant rabbits and causing similar abortion rate. There is no evidence that diphtheria produces congenital anomalies analogous to those produced by virus diseases such as German measles.

Stoeckel stated that if abortion or premature labor did not occur, the newborn was immune to diphtheria. Ollier noted that in certain cases the child of a diphtheritic mother was not born immune. Ribadeau-Dumas and co-workers demonstrated that immunization of mothers with anatoxin was ineffectual as a prophylaxis against diphtheria in the newborn. They also felt that infants under four months were refractory to immunization. Bourquin and Richardson proved the passage of antitoxin across the placenta, and more recently Liebling and his associates have clearly shown that active immunization of mothers with toxoid during pregnancy raises the fetal antitoxin titer, which reaches equal concentrations in mother and infant, and that the latter is in all cases Schick negative at birth. Brescia emphasizes that the frequently held concept that all infants are practically immune to diphtheria at birth is fallacious, and only infants born of immune mothers are themselves immune. Infants of these mothers give a negative Schick test in 100 per cent of the cases. However, at six months 80 per cent have become Schick positive. Infants born of nonimmune mothers show 50 per cent positive Schick reactions, and after four months are 100 per cent Schick positive. Fifty per cent negative Schick tests in the latter group may possibly be explained on the basis of poor skin reactivity shortly after birth, while the well-known unreliability of the Schick test in the newborn may lead one to question the findings in the former. Substantiating Ollier's statement that not all infants of diphtheritic mothers are immune are the case reports of Voron, Lyonnet, and Contamin, and Fleming. The French case report describes a 35-year-old woman who died shortly after her arrival at the hospital. Autopsy revealed tracheobronchial diphtheria. The patient, a para ix, had delivered a normal 3,050 Gm. female infant on the preceding day, which appeared healthy until the twelfth

day post partum, at which time she became febrile, developed coryza, otitis, and umbilical infection. A few days later the infant died of diphtheria. Fleming's case reveals that the mother became ill two days before delivery. On the day after delivery she was admitted with oral, vulvar, and anal diphtheria. Antitoxin therapy resulted in recovery. On the seventh postpartum day the baby was admitted with faucial diphtheria. Antitoxin therapy was again successful. Both cases indicate that the disease occurred so late in the pregnancy that there was insufficient time to build up an antitoxin level which would cross the placental barrier. As a result both infants were nonimmune.

The experience of the Johns Hopkins Hospital Department of Obstetrics with this disease follows in detail.

CASE 1.—(No. 20555.) A 20-year-old single Negro woman was first seen in the Outpatient Department on Sept. 20, 1906. Although her expected date of confinement was calculated to be in February, 1907, the pregnancy appeared to be slightly more advanced, and she was thought to be due in January, 1907. Her prenatal course was uneventful until Dec. 22, 1906, when the patient first complained of headache and sore neck. On December 23, her temperature was 101, her pulse 104, and her throat sore. She had a small white membranous patch on the soft palate and the tonsils and pharynx were diffusely injected. Culture revealed Klebs-Löffler bacilli, and the patient was given 1,500 units of antitoxin. On December 24, an additional 1,500 units were given, and the patient felt much improved. Her temperature was 98 and pulse 74. By December 30 the membrane had disappeared and the patient was asymptomatic. Cultures of the throat were negative. There were never any signs of cardiac, neurological, or renal involvement. The urine was constantly negative. Pregnancy proceeded uneventfully. On January 29 the patient went into labor spontaneously, and was delivered under chloroform anesthesia of a normal female infant weighing 2,980 grams. The puerperium was uncomplicated, and the patient was discharged on the tenth postpartum day. The baby was in excellent condition and weighed 3,220 Gm. at discharge.

CASE 2.—(No. 372477.) A 20-year-old white married para 2-2-0-0-2, whose expected date of confinement was April 6, 1946, was admitted to the Johns Hopkins Hospital on Jan. 7, 1946, breathing noisily through a tracheotomy tube. Her family history was noncontributory. She had never received diphtheria toxoid. The present prenatal course had proceeded normally until one month before admission, when the patient developed otitis media requiring left myringotomy. Purulent material had been draining from the left ear ever since. About three weeks before admission, labored respirations and lacrimation of the left eye began. Two days before admission the patient lost her voice and was seen in a hospital in Miami. The vocal cords were covered with a fibrinous exudate, and a pneumococcus grew out on culture. The patient was advised to seek help in a larger medical center. She was flown to Baltimore aboard a C-47, which fortunately carried a medical officer. Over Charleston, South Carolina, the patient developed complete respiratory obstruction, and an emergency tracheotomy was performed in midair. On admission the temperature was 99.8° F., pulse 112, and respirations 24 and noisy. Blood pressure was normal. Physical examination revealed complete nasal obstruction. Anteriorly in the nasal passage was a whitish membrane. The pharynx and tonsils were diffusely injected, and the tonsillar nodes were enlarged and tender. The tracheotomy tube was functioning well. Both ears drained purulent material. The fundus rose to one fingerbreadth above the umbilicus, and the fetal heart was present in the left lower quadrant. Pharyngeal culture was positive

for Klebs-Löffler bacilli but cultures from the other sites involved were negative. She was given 60,000 units of antitoxin, and 30,000 units of penicillin every three hours and neosynephryn nose drops. Examination of the abdomen revealed an estimated 1,000 Gm. fetus in left occipitotransverse position, with the fetal heart in the left lower quadrant. Progress was slow, but by January 21 cultures of the throat were negative for diphtheria bacilli. Shutting off the tracheotomy tube was intolerable. She was given local radium treatment to the hypertrophied pharyngeal lymphoid tissue, and late in January began to tolerate some plugging of the tracheotomy tube. On March 9, tonsillectomy, adenoidectomy, and bilateral myringotomy were performed. She fell into labor spontaneously on April 10, and after an eleven-hour labor delivered an infant weighing 2,960 Gm., which was in good condition. The puerperium was uncomplicated, and the patient and her baby left the hospital in good condition in June, except for the fact that the tracheotomy tube was still in place.

CASE 3.—(No. 375518.) The patient was a 20-year-old para 6-5-1-0-4, whose expected date of confinement was Nov. 21, 1946. On April 17, 1946, the patient's 2½-year-old daughter died of diphtheria. Two weeks prior to this her 4-year-old son had had a sore throat for three days. The patient had never received any toxoid or antitoxin. She was admitted on April 19, 1946, with a history of sore throat and nausea and vomiting for three days. During the preceding twenty-four hours she had experienced great difficulty in swallowing. On admission her temperature was 100° F. She had large, inflamed tonsils, and both were covered with adherent, grayish membrane. Pharyngeal culture was positive for Klebs-Löffler bacilli. Her electrocardiogram was normal. She received 80,000 units of antitoxin intramuscularly, 80,000 units of penicillin every three hours, and 100 mg. of ascorbic acid twice a day. She responded promptly, and on April 24 the membrane had disappeared, the temperature was normal, and penicillin was discontinued. The first negative cultures were obtained on May 1, 1946. Pelvic examination was first done on May 7, and revealed an estimated twelve weeks' pregnancy with the uterus rising to four fingerbreadths below the umbilicus. During the patient's course in the hospital she had no abdominal cramps or bleeding. On May 20, 1946, she developed partial palatal paralysis. This, however, disappeared, and she was discharged on June 6, 1946. She was delivered spontaneously of a 3,540 Gm. female infant on Nov. 18, 1946. Both the patient and her child did well.

CASE 4.—*Sydenham History No. 34089*: The patient was an 18-year-old primipara whose expected date of confinement was May 29, 1946. Her prenatal course was uneventful. On April 23 the patient developed a sore throat, and was hospitalized at another hospital where she was treated with penicillin without results. On April 29, cultures revealed Klebs-Löffler bacilli. She was given 80,000 units of antitoxin and transferred to Sydenham Hospital. She had never received toxoid. On admission she was moderately ill with gray adherent membrane over both tonsils. Temperature was 98° F. The uterus was one fingerbreadth below the xiphoid, and a fetus estimated at 2,400 Gm. lay in left occipitotransverse position with the fetal heart in the left lower quadrant. Five days after admission the throat culture was negative and sterile vaginal examination was carried out. The cervix was long, closed, and the pelvis was measured as normal. Electrocardiogram revealed a depression of the S.T. segments, and this was regarded as evidence of beginning myocarditis. On May 12 the patient began to develop palatal paralysis and difficulty in accommodation. She fell into labor spontaneously on May 29, and after a moderately difficult labor characterized by uterine inertia she was delivered by low forceps of a 2,820 Gm. infant which was in fair condition.

Twenty-four hours after birth the infant exhibited some regurgitation of food when feeding was attempted. There was unilateral impaired palatal action. An electrocardiogram of the infant showed no abnormality. Twenty-four hours later the palatal paralysis disappeared. The infant had less than 1/1000 unit of antitoxin per c.c. of blood, though the mother was Schick negative. It was therefore given 20,000 units of antitoxin prophylactically and was separated from its mother. The initial difficulty in swallowing was considered not to be due to the effect of the diphtheria toxin, but rather an expression of the general muscle flaccidity following a slightly difficult delivery and prolonged labor. The patient left the hospital on her tenth postpartum day. At this time the infant was in good condition.

CASE 5.—(No. 390965.) The patient was a 28-year-old white para 4-3-0-1-3, whose expected date of confinement was December 16, 1946. The present illness began with headaches on May 11, and on May 14 she developed sore throat and painful swallowing. She was treated with sulfadiazine and penicillin without results, and entered Sydenham Hospital on May 16. On admission her temperature was 100° F. She did not appear to be acutely ill. The tonsils were enlarged and injected. There was a grayish membrane over the left tonsil anteriorly. There was some membrane also on the posterior pharyngeal wall. Abdominal examination revealed a fourteen weeks' pregnancy with the uterus rising to three fingerbreadths below the umbilicus. Throat cultures taken on May 16, 17, and 18, were positive for Klebs-Löffler bacilli. Pelvic examination at this time confirmed the diagnosis of pregnancy. The patient was treated with 40,000 units of penicillin every three hours. In addition she received 100,000 units of antitoxin intramuscularly, and 100 mg. of ascorbic acid twice a day. Following the administration of the antitoxin the temperature rose to 103° F., but subsided rapidly. One week later the patient began to run daily temperature elevations to 101° F. and 102° F., and on May 27 she developed joint pains, and an urticarial rash appeared over her body. The membrane disappeared from her throat on May 21. On June 11 the electrocardiogram revealed a decreased amplitude in all levels, and it was felt that she had a mild myocarditis. In spite of the serum sickness, her pregnancy progressed uneventfully.

The patient was readmitted in July, 1946, with peripheral neuritis involving the lower extremities. She was treated with bed rest and thiamin, and was discharged after three weeks, greatly improved. Her pregnancy progressed normally during this admission.

She was delivered of a 4,020 Gm. male infant in good condition on Dec. 26, 1946. Both mother and child did well and were discharged from the hospital on the sixth postpartum day.

Discussion

A fundamental question in regard to this complication of pregnancy is whether the diphtheria bacilli and/or its toxin pass through the placental barrier. No one has ever succeeded in demonstrating the Klebs-Löffler bacillus in the placenta, and congenital transmission of this disease has never been proved. The organism has never been shown in fetal blood. Needham states that with very few exceptions toxins and antigens do not pass through the placenta. On the other hand, the placenta is readily permeable to antitoxin. Therefore, immunity in the fetus at birth, if present, is always passive and transitory. Schmidlechner, in 1904, however, using term guinea pigs as test

animals, injected large doses of diphtheria toxin subcutaneously. These invariably killed the animals. Autopsy findings in the fetuses and mothers showed identical findings, namely, parenchymatous and fatty degeneration of the organs, and hemorrhage in the adrenals. When smaller doses were used, no pathologic changes were noted in the fetal organs, though the maternal organs were characteristically affected. Using even greater massive doses, he injected guinea pigs at term and performed cesarean sections upon them six to twelve hours later. Following this, he injected large doses of the fetal serum into other pregnant guinea pigs, with death and typical pathologic changes ensuing in both the maternal and fetal organs. These experiments seemed to prove conclusively in the guinea pigs that toxin does pass the fetal barrier. This work could not be substantiated by Nattan-Larrier, Ramon, and Grasset, who injected term rabbits with 15 c.c. of toxin (1/400 c.c. lethal to the guinea pig). Eight hours later cesarean section was performed and a living litter obtained. Two c.c. of the serum of these fetuses were then injected into guinea pigs with innocuous results, while 1 c.c. of the mother's serum proved fatal. Similar results were obtained using guinea pigs as test animals. Furthermore, typical adrenal gland changes produced by the toxin in mothers were lacking in the fetus. To prove fetal immunity was passive, these same investigators injected 2,000 Ehrlich units of antitoxin intravenously into rabbits at term. Delivery occurred the following day. Following delivery, 1 c.c. of maternal serum neutralized 80 MLD of toxin, while 1 c.c. of fetal serum neutralized 25 MLD of toxin. Therefore, these investigators concluded that the placenta is permeable to antitoxin, but impermeable to toxin. Confirmation of the above findings was reported by Mouriquand and his co-workers, who injected 12 term guinea pigs with toxin. In the guinea pig, toxin produces hemorrhagic changes in the adrenals with marked decrease in adrenalin and cholesterol content, the maximal effect being reached in sixteen hours. After sixteen hours the animals were sacrificed. All the mothers exhibited typical adrenal changes, while none of the offsprings' adrenals was affected. It should be noted at this point that the placentas of guinea pigs and term rabbits are hemoendothelial, and, as such, are more permeable than the human placenta which is hemochorial. Clinically, the nonpassage of toxin in man is evidenced by the fact that not a single case appears in the literature of a child having been born with diphtheritic myocarditis or diphtheritic paralysis. The available evidence seems to point definitely to the placenta as an effective barrier against the passage of toxin. While our Case 4 did exhibit palatal paralysis for a short time and might prove to be an exception to this rule, it was the feeling of all observers that the rapid recovery and general flaccidity of this infant at birth would seem to indict the long labor and difficult delivery rather than diphtheria toxin in the fetal blood.

In the reported cases, pregnancy did not seem to alter the course of the disease in any way, nor in the few cases here reported did the disease seem to alter the course or the outcome of pregnancy. Such cases should be treated in manner similar to diphtheria in the nonpregnant individuals. Antitoxin is the single most important therapeutic agent. Secondary infections can be

controlled by chemotherapy and antibiotics. Myocarditis, of course, should be treated by bed rest. Although the reported abortion rate in diphtheria is 33 per cent, no interruption of pregnancy was observed in our cases, and none of them showed any premonitory signs of miscarriage. Abortion in acute infectious diseases with high fever, however, is not uncommon, and it is conceivable that inadequately treated diphtheria might result in a high abortion rate.

Summary

1. A review of the literature of diphtheria in pregnancy is presented.
2. Five instances of diphtheria in various stages of pregnancy are reported.
3. There is no indication from these cases that adequately treated diphtheria increases the incidence of abortion or premature labor.
4. No evidence was found in the literature nor was any obtained from these cases that might indicate the passage of diphtheria toxin across the placental barrier.

References

- Berkeley, C., Bonney, V., and MacLeod, D.: *The Abnormal in Obstetrics*, London, 1938, Edward Arnold and Company.
- Bourquin, H.: *Am. J. Physiol.* 59: 122-143, 1922.
- Brescia, M. A.: *Arch. Pediat.* 59: 513-524, 1942; correction 59: 690, 1942.
- Broer, J. L.: *Zentralbl. f. Gynäk.* 44: 1138, 1920.
- Bumm, E.: *Ztschr. f. Geburtsh. u. Gynäk.* 33: 126-136, 1895.
- Canéva, Thèse de Paris, 234, 1852.
- DeLee, J. A., Greenhill, J. P.: *Principles and Practice of Obstetrics*, Philadelphia, 1943, W. B. Saunders Company.
- Döderlein, A.: *Handbuch der Geburtshilfe II*, p. 399, München, 1925.
- Fleming, J. B.: *Brit. M. J.* 2: 677-678, 1943.
- Halban, J., and Seitz, L.: *Biologie und Pathologie des Weibes*, Berlin, 1929, Urban & Schwarzenberg.
- Kennedy, J. M.: *J. Laryng. & Otol.* 59: 243-249, 1944.
- LeFevre, L.: *J. A. M. A.* 90: 1015-1016, 1928.
- Liebling, J., Youmans, G. P., and Schmitz, H. E.: *J. Obst. & Gynaec. Brit. Emp.* 41: 641, 1941.
- Lietz, F. H.: *Monatschr. f. Geburtsh. u. Gynäk.* 52: 340-346, 1920.
- Lönne, F., and Meyeringh: *Zentralbl. f. Gynäk.* 44: 1018-1021, 1920.
- Mouriquand, G., Leulin, A., and Sedallian, P.: *Compt. rend. Acad. d. sc.* 190: 454, 1930.
- Nattan-Larrier, L., Ramon, G., and Grasset, E.: *Compt. rend. Soc. de biol.* 93: 241-243, 1927.
- Nattan-Larrier, L., Ramon, G., and Grasset, E.: *Ann. Inst. Pasteur* 41: 862-867, 1927.
- Needham, J.: *Biochemistry and Morphogenesis*, Cambridge, England, 1942, The University Press.
- Needham, J.: *Chemical Embryology*, Cambridge, England, 1931, The University Press.
- Ollier, M.: *Diphtherie et Grossesse*, Thèse de Paris, 1904.
- Priestley, W. O.: *Brit. M. J.* 1: 660-669, 1887.
- Ribadeau-Dumas, L., et al.: *Bull. et mém. Soc. méd. d. hôp. de Paris. Ab. J. A. M. A.* 85: 933, 1925.
- Richardson, L. V.: *J. Immunol.* 22: 351-358, 1932.
- Schmidlechner, C.: *Ztschr. f. Geburtsh. u. Gynäk.* 52: 377-395, 1904.
- Stander, H. J.: *Textbook of Obstetrics*, New York, 1945, D. Appleton-Century Company, p. 1145.
- Stoeckel, W.: *Lehrbuch der Geburtshilfe*, p. 581, 1920.
- Voron, J., Lyonnet, R., and Contamin, R.: *Bull. Soc. gynéc. et d'obst.* 25: 83-85, 1936.
- Wauschkuhn, F.: *Zentralbl. f. Gynäk.* 44: 820-824, 1920.
- Williams, J. W.: *AM. J. OBST. & GYNEC.* 38: 180-185, 1898.

DYSGERMINOMA OVARIUM

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ALTHOUGH fifteen years have elapsed since Robert Meyer enriched our knowledge of ovarian tumors, opinion still is divided both with regard to the degree of malignancy of dysgerminoma of the ovary and the nature of its surgical management.

Of course this difference may in part be attributed to the comparative rarity of this special pathologic growth, but since about 250 cases have already been reported in the literature and many other observed cases no doubt remain unpublished, the concerned problems become one with which every physician should be thoroughly familiar.

It is, therefore, rather astonishing that in a number of surgical textbooks which have appeared within the past two or three years, this subject is wholly ignored, while in others the authors are at variance regarding the nature and management of this form of ovarian neoplasm. As something unique, mention should be made of the fact that Bourne¹ in his "Synopsis" makes this astounding statement under the heading dysgerminoma, which he correctly classifies among sex-cell tumors of the ovary: "Benign in female, malignant in male. Bilateral in women. Chiefly found in young women."

We shall show that the author is in total error, and that such teaching of undergraduates may eventually lead to disastrous consequences.

Abstracts From the Literature

In view of the above statements it may not be amiss at this place to cite a few of the many contributions to the literature in this particular field.

Dworzak,² in 1935, reported the case of an 18-year-old girl with unilateral dysgerminoma for which he extirpated the right ovary and tube with the growth. There appeared a recurrence in the left adnexa, which responded to radiation. Three years earlier this author had operated conservatively on four older women and all these patients died.

Novak and Gray,³ in 1936, reported their exhaustive study of 17 cases, and reached the conclusion that dysgerminoma is a highly malignant tumor compelling disregard of future pregnancy. These authors decided that radical operation is the indicated method of managing this type of tumor and not mere unilateral extirpation with subsequent radiotherapy.

Foderl,⁴ in 1938, reviewed 13 cases and reached virtually the same conclusion as that of Novak and Gray. He urged radical intervention because the prognosis is very grave.

Seegar,⁵ in 1938, contributed a study of no less than 79 cases, most of the concerned individuals being under 20 years of age and without any evidence of pseudohermaphroditism. He found that the mortality rate ranged between 35 and 60 per cent, depending upon the character of the surgical procedure employed.

Russell,⁶ in 1938, published his experience which contained a valuable lesson. In one instance out of seven there was a unilateral dysgerminoma and this woman died as a result of recurrence in the opposite ovary.

Stoia and associates,⁷ in 1930, reported three cases of dysgerminoma. In these death took place as a consequence of metastases.

Sailer,⁸ in 1940, published five cases in which the ages ranged between 10 and 21 years. In four of these the dysgerminoma attacked the right ovary, and only in one was the neoplasm found on the left side. After conservative operation one of the patients died after a year, while the others remained under observation.

As stated above, it is not my intention to review the entire literature on dysgerminoma of the ovary, but it is palpable from the few above abstracts that we are dealing with a problem meriting serious consideration of several involved factors.



Fig. 1.

Case Report

A single, white, 23-year-old woman was admitted to Edgewater Hospital in May, 1945, with a complaint of nocturia, diurnal polyuria, and of a rapidly growing mass in the lower left side of the abdomen. This condition was stated to have existed within the preceding six weeks.

The previous history has a bearing on the case only to the extent that it definitely establishes the time element of the present complaint. She had been recently hospitalized on two occasions; once in February for a submucous resection, and in March of the same year at Edgewater Hospital for a nasal hemorrhage. A general physical examination was made several days after her nasal operation, and another at Edgewater Hospital after her admission for the nasal hemorrhage. The records of the latter general examination contain absolutely nothing about the presence of a mass in the abdomen.

Physical Examination.—The patient was in every respect a normal, well-developed young woman, weighing 115 pounds and a height of five feet, two inches. The distribution of hair on her face, body, and pubes was normal. The hymen was intact. The mass, about the size of an eight months' pregnancy, filled the entire left lower half of the abdomen, extending about three finger-

breadths above the umbilicus. It was firm in consistency and gave the impression of being lobulated. Careful vaginal examination yielded little additional information. The introduction of a small speculum revealed a normal cervix, but rectal palpation showed the mass to occupy most of the left cul-de-sac, and confirmed the lobulated character of the growth.

Past History.—Her catamenia appeared at the age of eleven, was the 28-day type, with the flow lasting three days. The flow was rather scanty, but not associated with pain. She had undergone a tonsillectomy and a mastoidectomy about eight years ago. Her septal operation is mentioned above.

Diagnosis.—With flat x-ray films showing a massive shadow in the lower left abdomen and pelvis without the presence of any calcified areas, the diagnosis of left ovarian tumor became a certainty.

Operation.—Laparotomy through a low midline incision was performed on June 2, 1945. The section revealed a large amount of free fluid and a mass the size of an adult's head firmly embedded in the left pelvis. It was grayish in color resembling a brain, firm, and lobulated. It involved the entire left ovary (Fig. 1).

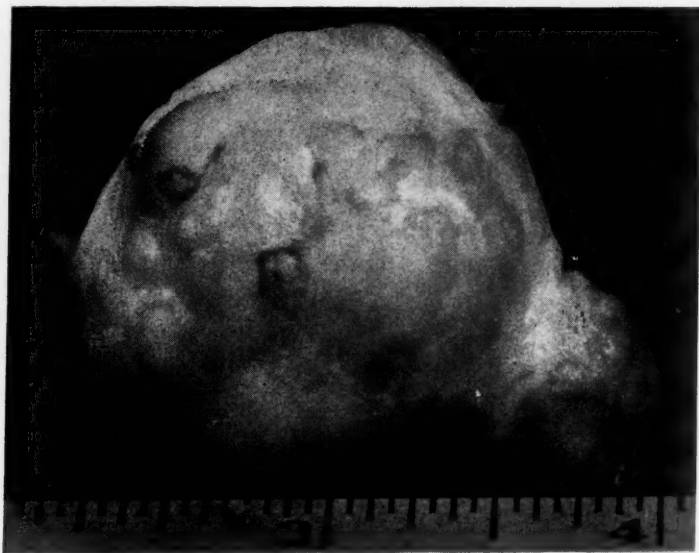


Fig. 2.

The broad ligament was about four times its normal thickness, and was intensely vascular. Further exploration revealed a similar but much smaller tumor, about the size of a hen's egg attached to the right ovary (Fig. 2). There was no involvement of the tubes, ligaments, uterus, or mesenteric glands. The liver, omentum, and other viscera appeared to be normal.

The left ovary and tumor were removed in toto. Without previous permission for more radical surgery, it was deemed advisable to restrict the procedure to removal of the major portion of the right ovary with the growth in order to gain time for microscopic study and, if need proved, to obtain consent for more radical surgery. We felt justified in this delay also clinically, because of the absence of metastases either in the pelvis or elsewhere.

The patient made an uneventful recovery and was temporarily discharged on the tenth postoperative day.

Pathologic Report.—(Path. No. 13095—Hosp. No. 68322). The specimen consisted of two ovaries and one Fallopian tube, the largest measuring 17 by

19 by 8 centimeters, to which was attached the left tube. The smaller ovary measured 4 by 4 by 2½ centimeters. The capsules of both ovarian masses were smooth and intact, grayish in color. The veins at the pedicle of the large tumor were greatly dilated and tortuous. Both tumors felt solid. The larger tumor cut with great ease and fragmented slightly. The cut surfaces presented a soft, easily fragmented stroma, red in color. The stroma had a mottled-gray appearance with some areas dark red and hemorrhagic, and others appearing

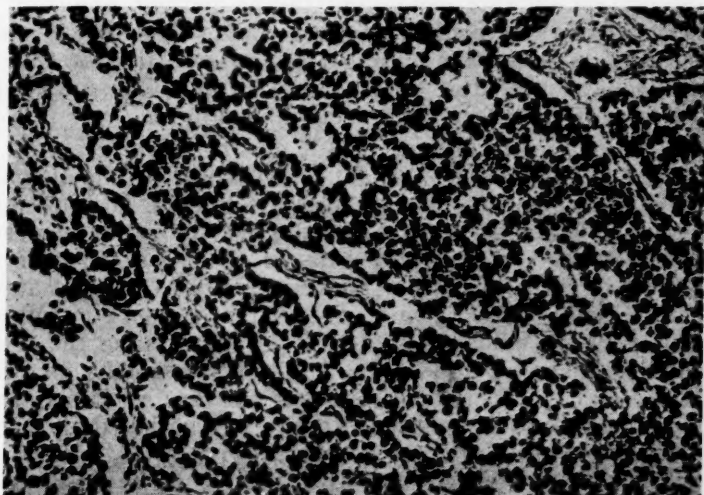


Fig. 3.

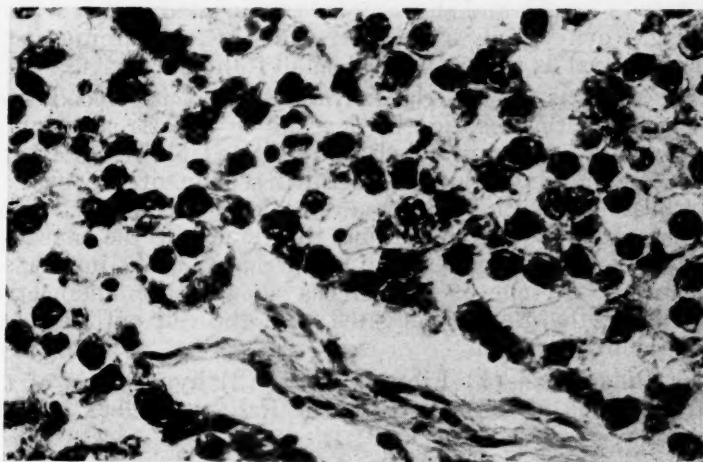


Fig. 4.

grossly to be necrotic and in some places liquefied. The smaller of the two tumors was covered by peritoneum and appeared to be complete. It had attached a small part of the ovary, was also friable, but presented a more homogeneous curly white cut surface. The Fallopian tube measured 8 centimeters in length, and revealed open fimbriated ends. There was no gross involvement of the tube.

Microscopic Findings.—The sections showed cords and nests of extremely pleomorphic and anaplastic cells throughout. They varied in size and staining

qualities with many evidences of mitosis. The stroma was extremely loose, and consisted of strands of fibrous tissue with areas of edema and hemorrhage. Scattered among the tumor cells were focal and diffuse accumulations of small round cells resembling lymphocytes. The Fallopian tube showed that the mucosa was partially filling the lumen and the muscularis. The tube proper was otherwise normal (Figs. 3 and 4).

Pathologic Diagnosis.—Dysgerminoma of ovaries.

Second Operation.—After explaining to the patient and her family the malignant character of the growths and the ultimate chances for recovery after a radical operation, consent was obtained and a second operation performed on July 5, about one month after the first procedure. This operation consisted of total extirpation of the uterus and remaining adnexa.

Again the patient made an uneventful and complete recovery. She sustained during her convalescence a slight disturbance of the urinary bladder as a result of catheterization, but was able to leave the hospital on the tenth postoperative day. The operation was followed by an intensive course of radiation. She also was given 10,000 units of theelin in oil every other day and one-half grain of phenobarbital three times daily to prevent any symptoms incident to her sudden artificial menopause. This regimen controlled the situation, except for periodic evidence of nervousness. In time the dosage of the medication could be reduced, and at the end of three months no further treatment proved necessary. To date of writing she has remained in a normal condition, free from any symptoms and able to pursue her daily work.

Second Pathologic Report.—(Path. No. 13115—Hosp. No. 69106). The specimen consisted of the uterus and cervix 8 by 4 by 3 centimeters. The cervical epithelium was smooth; the endometrium reached a thickness of 3 millimeters and was smooth. Attached was the right Fallopian tube measuring 8 centimeters in length and showing free fimbriated ends. Attached to the tube was the right ovary, 3 by 3 by 1.5 centimeters, containing corpus luteum and a hemorrhagic cyst as well as several small follicular cysts.

Microscopic sections of the right ovary showed the blood vessels to be markedly thickened with hemosiderin deposits in the stroma lining the wall of the cyst. Another section revealed many dilated blood vessels with hemorrhage into the surrounding stroma. A third section of the ovary contained a large hemorrhagic cyst with the stroma essentially unchanged. The Fallopian tube showed the mucosa partially filling the lumen of the muscularis. And a fourth section of the ovary showed hemorrhagic cysts in the stroma and corpora albicantia. Section of the uterus showed the endometrium to be markedly thickened, the glands elongated with the cell outline intact. There was fibrosis in the myometrium.

Pathologic Diagnosis.—(1) Fibrosis uteri; (2) hyperplasia of the endometrium; (3) hyperplasia of the mucosa of the Fallopian tube; (4) hemorrhagic cysts of the ovary.

Comment

In the light of clinical experience and pathologic studies of dysgerminoma ovarii, there is no room for doubt that this neoplasm is highly malignant. As a corollary, its surgical management logically must be as radical as that of carcinoma of the ovaries.

Since the neoplasm attacks even the very young, it is but natural for humane surgeons to hesitate in carrying out an operation that precludes future pregnancy, especially when the capsule of the growth is unbroken. In such a

case one is tempted to restrict oneself to a conservative removal of the tumor, and to rely upon postoperative radiation to prevent metastases.

But once the diagnosis is made, the most pressing objective is not the conservation of potential procreative power, but the preservation of life itself. To this should be added that after a course of x-ray therapy ovarian function will be destroyed in virtually all cases.

Given a growth with an unbroken capsule, the diagnosis after its exposure is not always possible macroscopically, for which reason resort should be had to microscopic section of the removed growth, since the establishment of the correct diagnosis dictates the course to be pursued in the very young as well as mature patients. Certainly radical extirpation of the genital apparatus should be carried out only with the consent of the patients or their parents, but, when these are explained, the reason for the operation as a lifesaving measure, no difficulty will be experienced in most instances in obtaining such permission. In the very young a compromise may be effected by pointing out that every conservative intervention makes it incumbent to keep the concerned patient under observation in order to enable the surgeon to detect an extension of the growth or the appearance of metastases.

References

1. Bourne, A. W.: *Synopsis of Obstetrics and Gynaecology*, Baltimore, 1945, Williams and Wilkins Company.
2. Dworzak, Hans: *Zentralbl. f. Gynäk.* 59: 1282, 1935.
3. Novak, Emil, and Gray, Lamana: *AM. J. OBST. & GYNEC.* 31: 213, 1936.
4. Foderl, V.: *Arch. f. Gynäk.* 165: 392, 1938.
5. Seegar, G. Emory: *Arch. Surg.* 37: 697, 1938.
6. Russell, P. M. G.: *J. Obst. & Gynaec. Brit. Emp.* 45: 258-264, 1938.
7. Stoia, I., Stanculescu, P., and Cioc, M.: *Bulletin Assoc. franç. p. l'étude du cancer* 28: 999, 1939.
8. Sailer, Seaton: *Am. J. Cancer* 38: 473, 1940.

MEIGS'S SYNDROME; A CASE REPORT AND A REVIEW OF RECENTLY PUBLISHED CASES

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THE publication by Meigs and Cass¹ in 1933 of an article describing seven cases of ovarian fibroma associated with ascites and hydrothorax was a milestone in gynecology. Their original communication called attention to the fact that patients with what was subsequently termed "Meigs's syndrome" frequently present a clinical picture almost identical with that of far-advanced malignancy. They clearly stated that, in an occasional apparently hopeless case, though the surgeon must risk the dangers of a possible postoperative mortality, he may be rewarded by a most gratifying result. Meigs has emphasized this very important fact in all of his subsequent papers.²⁻⁴ Unfortunately, while the medical world in general and gynecologists in particular are now thoroughly familiar with the symptom triad of Meigs's syndrome, there appears to be a lack of understanding of the primary purpose of his contributions on this subject.

By 1943, Meigs and co-workers⁴ had collected 27 cases of the syndrome. Since that time 16 additional cases have been reported in the literature to which there is added the case detailed below. In his latest paper, Meigs tabulated the cases in a fashion similar to Table I. His table has merely been continued, in this way bringing the literature up to date. However, one column has been added to Meigs's table, i.e., the weight or size of the tumor.

All the cases reported by Meigs have been reviewed in order to establish the weight or size of each tumor. While the weights in many cases are not given, estimating them from the stated dimensions of the tumor, we may conclude that, with the exception of two, that of Bomze and Kirshbaum⁵ and that of Mac Fee,⁶ probably none of the others weighed more than 2,500 to 3,000 grams. The largest ovarian fibroma exhibiting the syndrome was found in the case reported by Bomze and Kirshbaum. This tumor, which weighed 7,150 Gm., was not removed at operation, due to the poor condition of the patient. Two days later the patient died, and it was recovered at autopsy.

In 1941, Mac Fee reported a case in which he removed a multilocular cystadenoma of the left ovary which weighed over 8 kilograms. This patient had fluid in the abdominal and chest cavities. She made an uneventful recovery from the operation. However, during her period of convalescence, it was necessary to do a thoracocentesis. In 1945, Millett and Shell⁷ reported the case of a large multilocular pseudomucinous cystadenoma extending to the umbilicus. The weight and size were not given. In this case, too, a postoperative chest tap was done. The authors of both of these case reports stated that they believed they were dealing with Meigs's syndrome. However, it is the opinion of the present author that the term "Meigs's syndrome" should be confined to

the triad of solid tumor of the ovary, ascites, and hydrothorax because: (1) It is so considered by the vast majority of physicians at all acquainted with it. (2) If the issue becomes clouded by including in this category tumors which are at least potentially malignant and primarily cystic in character, the important and definite understanding of the benignity of the whole syndrome will, in all probability, be lost. (3) The two cases mentioned above (Mac Fee, and Millett and Shell) failed in one important respect to conform to the typical clinical picture; that is, the chest fluid was not rapidly and spontaneously eliminated. In a private communication, Dr. Meigs states: "I don't think that papillary tumors or any kind of tumor that is not of the solid variety should be considered" (as cases of Meigs's syndrome).

The possibility of the diagnosis being missed in many cases must be considered, since Meigs operated on two patients exhibiting the syndrome within one year (1941).⁴ After all, 1,000 to 1,500 c.c. of fluid in the chest cavity need not produce symptoms, and a rather thorough physical examination or chest x-ray would be necessary to establish its presence. No comment is needed as to the infrequency of either of these procedures on the average surgical service.

After a review of all cases of Meigs's syndrome, I would suggest that both ascites and hydrothorax probably appear only after the tumor has been present for some time. In other words, almost all cases of Meigs's syndrome thus far reported might be classified as neglected, or perhaps better to say unexamined, patients. From this we may further conclude that, were it not for the fact that vaginal examinations are so common today we would see many more cases in this category.

Case Report

M. M., aged 55 years, white, para 0, gravida 0, single, was first seen on Sept. 3, 1944. She complained of a large mass rising from the groin and extending halfway to the knee. From the lowest part of the mass there was a constant discharge of clear, light yellow fluid. She stated that she had never before consulted a doctor. The family history and past surgical and medical history were negative. Her menses had ceased at the age of 47 years, and she had had an uneventful menopause, with no vaginal bleeding since that time. She first noticed a swelling in her right groin about ten years before. This had gradually increased in size until it finally reached almost to her knee. Approximately nine months prior to the time of her first examination, the lower part of this dependent mass had opened, allowing yellowish fluid to escape. After about six weeks this ceased, only to recur with an increasing amount of fluid two months prior to her visit to me. The patient complained of progressive weakness and complete loss of appetite with resultant muscular atrophy. The only other significant symptom was a nonproductive cough of increasing severity during the previous several months.

Physical Examination revealed a white, emaciated woman appearing considerably older than her stated age. Her weight was 108 lbs.; blood pressure, 190/110. The head and neck were essentially negative. The heart was enlarged concentrically with an apex rate of 100 per minute. The entire right chest to the axilla was flat on percussion, and only the most distant breath sounds were audible in this area. There was also some flatness at the left base. The abdomen was enlarged to the size of a full-term pregnancy and was filled with a hard, smooth, relatively freely movable mass which seemed to spring from the pelvis. The presence of ascites was demonstrated by a fluid wave and shifting dullness.

TABLE I. SYNOPSIS OF 17 ADDITIONAL

CASE AND DATE	SURGEON OR AUTHOR	AGE	STATUS	CHIL-DREN	CHIEF COMPLAINT
28. Dec., 1931	Healy ⁴	48	S	0	Swelling in abdomen; shortness of breath; abdominal pain
29. Oct., 1941	Jones ⁹	50	M	2	Loss of weight; weakness; shortness of breath on exertion; abdominal tumor
30. Nov., 1941	Perlmutter ¹⁰	60	M	1	Shortness of breath for two years; pain in right chest for one month
31. Feb., 1942	Watson et al. ¹¹	75	M	5	Weakness; palpitation; ankle edema
32. Mar., 1942	Taylor ⁴	72	M	6	Abdominal discomfort
33. June, 1942	Townsend ¹²	49	S	0	Progressive abdominal enlargement; weakness; dyspnea
34. Aug., 1942	Bottaro ¹³	58	M	1	Progressive abdominal enlargement; sudden onset five days before of flow of clear liquid from umbilical area
35. Sept., 1942	Kelemen ¹⁴	49	M	3	Cough dyspnea; weakness; diaphoresis
36. July, 1943	Mendel and Tyrone ¹⁵	44	S	0	Abdominal distention and pain
37. ?	Rubin et al. ¹⁶	52	M	?	Irregular menses; abdominal enlargement
38. ?	Rubin et al. ¹⁶	58	M	3	Dyspnea; leg edema; abdominal enlargement
39. Sept., 1943	Gardiner and Floyd-Hart ¹⁷	38	M	0	Shortness of breath on exertion; back pains
	Gild ¹⁸	30	M	0	Cough; shortness of breath; loss of weight for 2 months
40. ?					
41. Nov., 1943	Dockerty and Masson ¹⁹	43	M	1	Mass in lower abdomen with gradual enlargement in past year
42. Recently	Baird ²⁰	59	S	0	Breathlessness and lump in abdomen for one year
43. Recently	Baird ²⁰	47	M	1	Breathlessness for five years
44. Sept., 1944	Simon	55	S	0	Mass in the groin and abdomen; weakness; loss of appetite

*In this case the pathologist found bilateral papillary cystadenocarcinoma. However, the symptomatology and postoperative course was that of a typical Meigs's syndrome. The finding of a carcinoma in what appeared to be a simple ovarian fibroma was purely incidental. Three years postoperative the patient was reported to be in excellent health with no evidence of recurrence of the carcinoma.

CASES OF MEIGS'S SYNDROME

SITE OF TUMOR AND SIZE	LOCATION OF HYDROTHORAX	THORACENTESIS	ABDOMINAL PARACENTESIS	FLUID AT OPERATION
Bilateral; L—17 × 15 × 9 cm. R—small orange	Left	1	1	Not given
Left; size of grapefruit	Bilateral	0	0	9 qts. clear amber-colored fluid
Right; 1,300 Gm. 17 × 14 × 11 cm.	Right	12	0	1,500 c.c. straw-colored fluid
Bilateral; R—13 × 9 × 9.5 cm. L—3.5 × 4 × 3 cm.	Right	More than 9 times	0	200 to 300 c.c. clear yellowish fluid
Right; 20 cm.	Right	1	0	Not given
Right;* 15 × 23 × 23 cm.	Bilateral	6	0	Not given
Left; medium-sized melon	Right	0	2	Abundant serosanguineous
?	Right	Repeated	Repeated	Not given
Left; 12 × 7 × 7 cm.	Right	0	0	1 gallon
Right; 20 × 15 × 10 cm.	Bilateral	4	0	Not given
Left; 17 × 15 × 10 cm.	Right	3	1	Considerable amount
Left; 5 × 6 in.	Right	2	0	Some clear straw-colored fluid
Right; 20 × 20 × 15 cm.	Right	1	0	Considerable amount of clear yellowish ascitic fluid
Left; 1,370 Gm.	Bilateral	4	0	Considerable amount of ascitic fluid
Left; 8 in.	Right	1	0	Small quantity
Right; 7 × 6 in.	Right	Repeated	1, no fluid	Less than 1 pint
Right; 27 × 20 × 20 cm. 5,200 Gm.	Bilateral	1	0	750 c.c. straw-colored fluid

A large femoral hernia was noted extending from the right inguinal area to just above the knee. At the most dependent portion of the hernial sac was an ulcer 2 cm. in diameter, and from this point there was a constant discharge of a clear yellow-tinged fluid. The extremities were negative; there was no ankle edema.

The patient was immediately sent to City Hospital with a tentative diagnosis of Meigs's syndrome and femoral hernia. At the hospital, the clinical work-up showed the following:

Blood Count:

Hemoglobin	—	86% or 14.6 Gm.
R.B.C.	—	4.2 million
W.B.C.	—	12,150
Differential	—	normal
Type	—	0

Blood sedimentation time—1 hour plus

Urine:

Specific gravity	—	1.025
Albumin	—	1 plus
Sugar	—	negative
Microscopic	—	occasional hyaline casts

Blood Chemistry:

Sugar	—	73 mg. %
N.P.N.	—	35 mg. %
Serum albumin	—	4.13
Serum globulin	—	2.16
Total blood protein	—	7.7 mg. %
Wassermann	—	negative

Chest X-ray: Marked elevation of both diaphragms, especially the right and pleural effusion in the right lower chest which extends into the interlobar fissures.

The possibility of a vesicoinguinal fistula was considered. This was ruled out when injection of methylene blue into the bladder failed to color the discharge from the hernial sac.

At City Hospital the patient was seen by all members of the visiting staff, one or two of whom urged delay, believing that operation could only result in a fatality. It was suggested that the pathology would soon be revealed at autopsy. This conclusion was in spite of the fact that Meigs's syndrome was considered by all as a possible diagnosis. It is apparent, therefore, that the importance of Meigs's conclusion in his original paper, namely, that "the curability of certain seemingly hopeless conditions is emphasized"⁸ has been overlooked by many.

On Sept. 18, 1944, the patient was transferred to a private institution. That evening, 2,500 c.c. of clear yellow fluid was removed from her right chest in order to increase the aeration capacity of her lungs. No work-up was done, since all laboratory data were available from City Hospital. On September 19, a laparotomy was performed. The anesthesia used was intercostal block plus cyclopropane for the few minutes during which the tumor was being lifted from the abdomen. The abdomen was opened with a right paramedian incision and 500 to 750 c.c. of clear straw-colored fluid was noted. A large, smooth, almost round tumor of the right ovary, about 27 cm. in diameter, was found. The uterus itself was small and atrophic; the left tube and ovary were normal; the right tube was considerably elongated and thickened, but otherwise normal. The abdominal cavity was remarkably free of small and large bowel, since most of the intestines were in the hernial sac. A rapid right salpingo-oophorectomy was done and the abdomen closed in layers without drainage. During the operation a transfusion of 500 c.c. of blood was given, followed by 1,000 c.c. of 5 per cent glucose in normal saline intravenously.

Pathology.—Gross: The specimen consisted of an encapsulated, somewhat irregular mass 26 by 23 by 17 cm. in size. The consistency was hard, and the cut surface showed white interlacing bundles of fibers in a grayish stroma. In one area, toward the periphery, a few small cysts, up to pea-size in diameter, were seen. Prominent dilated vessels were noted in the capsule, and small sub-capsular hemorrhagic areas were present. Attached at one area was a tube 7 cm. in length and 0.3 cm. in diameter which was patent.

Microscopic: Sections showed small stellate cells with small spindle-shaped nuclei. They were arranged partly in parallel bundles, partly showed an interlacing pattern. Intercellular substance was scarce. The cells were uniform in appearance and did not show any evidence of hyperactivity.

Diagnosis: Fibroma of the ovary.

The postoperative course was almost incredibly uneventful, with the exception of the polyuria and resultant overdistention of the bladder discussed below. The temperature on the first postoperative day went to 102° F. at one reading, and thereafter was never above 100° F. On the fifth postoperative day, all signs of hydrothorax had completely disappeared. The patient was discharged from the hospital on her twelfth postoperative day, weighing 87 pounds. Just prior to discharge, a chest fluoroscopy revealed no evidence of hydrothorax.

An interesting and unanticipated minor complication followed excision of the tumor. The patient voided spontaneously shortly after operation and passed an average of 1,500 c.c. of urine a day which seemed more than adequate, considering that she was not receiving an excessive amount of fluid by mouth and had been given only one intravenous of 1,000 c.c. of 5 per cent glucose in normal saline postoperatively. By the third day, the patient was voiding involuntarily in bed and complaining bitterly of suprapubic pain. I catheterized her and obtained 1,500 c.c. of urine notwithstanding the fact that during the previous twenty-four hours she had passed an equal amount. The resorption of the pleural exudate following operation was so rapid that the patient developed an overdistended bladder. This conclusion is substantiated by the fact that a careful physical examination of the chest on the fifth postoperative day revealed no signs of pleural effusion.

Follow-up.—After three weeks of convalescence in the country, the patient was again seen in my office on Oct. 5, 1944. She stated that she felt better than she had in years. She weighed 103 pounds; the scar was firm and, amazingly enough, the hernia had shrunk to about the size of an apple. The fistula had, of course, healed, and the skin covering the hernial sac had the wrinkled appearance of a scrotum. Most of the mass was made up of skin rather than abdominal contents. Two months later she weighed 112 pounds, the hernia had almost completely disappeared, but there was still a strong impulse on cough below Poupart's ligament in an area about 3 cm. in diameter. The blood pressure continued to be 190/100, but her general condition was otherwise excellent, and at this time she returned to work. On March 22, 1945, she weighed 123 pounds; the hernial sac had further shrunk, and she was told to limit caloric intake, as further weight gain was deemed inadvisable. She was last seen on April 4, 1946, and was in good health except for her hypertension.

Discussion

This case is a classic example of Meigs's thesis, that one must operate when operation is the sole hope. The patient was dying because of ascites and the constant loss of protein-bearing fluid, plus her actual physical inability to take in an adequate amount of food. This, in turn, was due to the limitation of space in her abdominal cavity because of the tumor itself.

Conclusion

1. A case is reported in which a solid ovarian tumor weighing 5,200 Gm., associated with ascites and hydrothorax, has been removed from a patient in an apparently hopeless condition.
2. Patients with Meigs's syndrome are in all probability being overlooked.
3. Attention is called to a possible minor postoperative complication which will surely prove distressing to the patient, if not to the physician.
4. The importance of giving every patient who presents the triad of pelvic tumor, ascites, and hydrothorax the benefit of operative exploration, no matter how hopeless her condition, is emphasized.
5. The term "Meigs's syndrome" should be reserved for those cases which present a solid ovarian tumor associated with ascites and hydrothorax.

References

1. Meigs, Joe V., and Cass, John W.: AM. J. OBST. & GYNEC. 33: 249, 1937.
2. Meigs, Joe V.: Fibroma of the Ovaries With Ascites and Hydrothorax (a New Syndrome), Frank H. Lahey Birthday Volume, Springfield, Ill., 1940, Charles C Thomas, p. 331.
3. Meigs, Joe V.: New England J. Med. 228: 52, 1943.
4. Meigs, Joe V., Armstrong, S. H., and Hamilton, H. H.: AM. J. OBST. & GYNEC. 46: 19, 1943.
5. Bomze, Edward J., and Kirshbaum, Jack D.: AM. J. OBST. & GYNEC. 40: 281, 1940.
6. Mac Fee, William F.: Ann. Surg. 113: 549, 1941.
7. Millett, Jos., and Shell, John: Am. J. M. Sc. 209: 327, 1945.
8. Meigs, Joe V.: AM. J. OBST. & GYNEC. 33: 265, 1937.
9. Jones, W. N.: J. M. A. Alabama 12: 199, 1943.
10. Perlmutter, Martin: Ann. Int. Med. 20: 132, 1944.
11. Herrick, W. W., Tyson, T. Lloyd, and Watson, B. P.: Arch. Int. Med. 71: 370, 1943.
12. Townsend, Stuart R.: Canad. M. A. J. 53: 245, 1945.
13. Solerno, Enrique V.: Prensa méd. argent. 30: 1883, 1943.
14. Kelemen, Edward: AM. J. OBST. & GYNEC. 47: 275, 1944.
15. Mendel, Evri B., and Tyrone, Curtis: AM. J. OBST. & GYNEC. 48: 271, 1944.
16. Rubin, I. C., Novak, J., and Squire, J. J.: AM. J. OBST. & GYNEC. 48: 601, 1944.
17. Gardiner, R. H., and Lloyd-Hart, V.: Lancet 2: 500, 1944.
18. Gild, Albert: J. Obst. & Gynaec. Brit. Emp. 50: 440, 1943.
19. Dockerty, Malcom V., and Masson, James C.: AM. J. OBST. & GYNEC. 47: 741, 1944.
20. Clay, A. C., Johnson, R. W., and Samson, L.: Brit. M. J. 2: 113, 1944.

PRIMARY CARCINOMA OF THE FALLOPIAN TUBE*

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THERE have been about 450 cases of primary carcinoma of the Fallopian tube reported in the literature up to the present time. A few of these have not been acceptable so that, at best, it is difficult to obtain an accurate count of this relatively rare disease. The accepted incidence is between 0.2 and 0.5 per cent of gynecologic malignancies. The age group is mainly in the fifth decade. Clinically the diagnosis is seldom made preoperatively and not always at the time of surgery. Most frequently it is made on microscopic examination of the tissue; over 95 per cent of the lesions are accounted for in this manner.

Seven cases of primary carcinoma of the Fallopian tube have occurred at St. Luke's Hospital since 1924. In one of these a tentative preoperative diagnosis of carcinoma of the tube was made. The latter case is described in detail, and the other six are briefly discussed.

Case Reports

CASE 1.—The patient, aged 56 years, white, para iv, gravida v, entered St. Luke's Hospital May 20, 1946. About one month before admission she noted a yellowish to brown viscid discharge from the vagina sufficient in amount to require her to wear a napkin. Two weeks following this, the discharge was blood-tinged for one day. At this time she developed a dull aching pain in the lower back and left lower abdomen. The patient had had a normal menstrual life; her last menses had been at the age of 53 years. She had a right mastectomy for a tumor the nature of which is not known. Family history for carcinoma was negative. The vaginal examination revealed a normal cervix and uterus. The right adnexa was considered normal on palpation. There was a soft, elongated, orange-sized, adherent mass in the left adnexa, which was thought to be the Fallopian tube. The left ovary was not palpable as such. A diagnosis was made of primary carcinoma of the left Fallopian tube. The patient was operated upon May 21, 1946.

At operation there was an estimated 250 c.c. of a chocolate colored fluid free in the abdominal cavity. There was an elongated, soft, red-blue adherent mass 6 cm. in diameter involving the left tube. The normal left ovary was loosely adherent to the mass. There was a right adherent tubo-ovarian inflammatory mass. There were several small fibromyomas in the wall of the uterus; the cervix was normal. A complete hysterectomy and wide removal of the adnexae was done. The left tube when opened revealed a papillary carcinoma tissue confined within the tubal wall. There was no demonstrable extension in the broad ligament, on the peritoneum, in the preaortic or the hypogastric lymph nodes. The right tube was opened and contained no evidence of carcinoma. The surgical diagnosis was primary carcinoma of the left Fallopian tube.

The essentials of the pathologic description were as follows: the dilated left tube was 10 cm. long and about 3 cm. in diameter; in the lumen there was a large amount of soft gray friable polypoid tissue that extended for a length of 5 centimeters. Both ovaries were normal. Microscopically, the left tube con-

*Presented before the Chicago Gynecological Society, Oct. 18, 1946.

tained papillary carcinoma tissues arranged on branching stalks of vascular fibrous stroma with infiltrations of lymphocytes. The carcinoma cells on these stalks had large vesicular nuclei and granular cytoplasm. Many were in mitosis. In some regions they formed masses of cells in which there were a few crevices and with small cores of fibrous tissue; in other regions their arrangement was more distinctly papillary on branched villous projections resembling the Fallopian tube. There was also some fibrous and smooth muscle tissue from the wall of the tube, having along the edge a few fibrous villi lined by columnar epithelium and continuous with an epithelium several layers deep with irregular projections. The histologic diagnosis was primary carcinoma of the Fallopian tube.

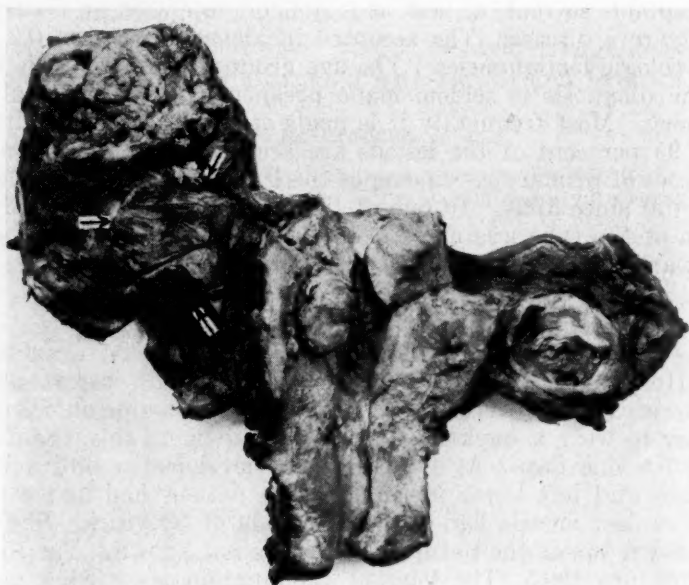


Fig. 1.—Gross specimen. The three arrows indicate the periphery of the left ovary.

The postoperative course of the patient was uneventful, and she was discharged on the fourteenth postoperative day. Deep pelvic x-ray therapy consisting of a total of 4,000 roentgen units was started before the patient was dismissed. In Sept. 1946, four months after surgery, there was no palpable evidence of carcinoma.

The other six cases are briefly described below.

CASE 2.—N. T., a 59-year-old para i, gravida ii, whose last menstrual period had been eleven years previously, entered St. Luke's Hospital July 22, 1924, because of left lower quadrant pain for six days. She had had chills and fever prior to admission. At operation the uterus was normal. The left Fallopian tube was 12 cm. long and within the lumen of the dilated distal end there was a firm mass 6 cm. in diameter consisting of yellow granular tissue. Microscopically, the lining of the Fallopian tube was composed of papillae with delicate fibrous stalks on which were several layers of proliferating epithelium, the outer layers columnar. The papillary masses infiltrated the wall of the tube. The histologic diagnosis was papillary carcinoma of the Fallopian tube.

CASE 3.—E. N., a 40-year-old nulligravida, with normal menses, entered St. Luke's Hospital Oct. 5, 1926, because of acute abdominal pain of twelve

hours' duration. The abdomen was distended. At operation the left tube was markedly dilated, club-shaped, 21 cm. long, and extruding through the end there was a firm gray-yellow mass 3 by 3 by 2 centimeters. The dilated, firm right tube was 12 cm. long and within the lumen, in the distal portion, there was a similar gray-yellow tissue. There were numerous small nodules of this tissue over the surfaces of the peritoneum and omentum. The uterus was not

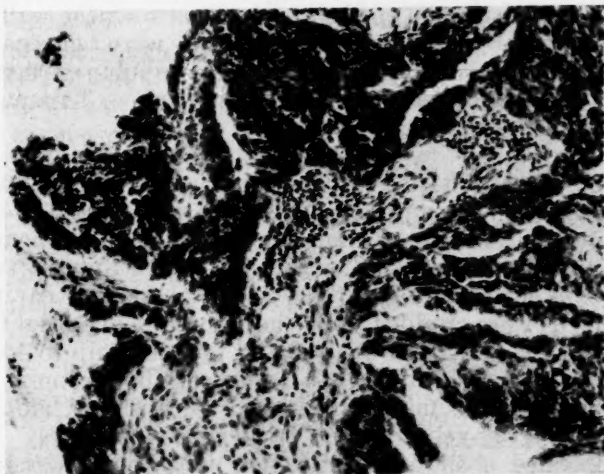


Fig. 2.—Microphotograph of vascular fibrous villous with many layered epithelium of carcinoma cells. ($\times 198$.)

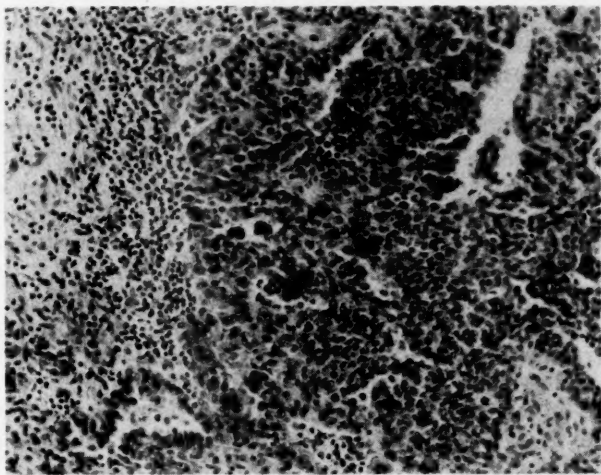


Fig. 3.—Microphotograph showing the solid masses of carcinoma cells. ($\times 198$.)

significant. The ovaries were not identified. The microscopic sections revealed infiltrating masses of epithelium arranged in papillary structures, but in some places tubular. The histologic diagnosis was bilateral carcinoma of the Fallopian tubes.

CASE 4.—F. H., a 58-year-old, para 0, gravida iii, whose last menstrual period had been five years previously, entered St. Luke's Hospital June 13, 1928, because of a vaginal discharge and slight bleeding of ten months' duration. She had had left lower abdominal tenderness for ten months, and she

had lost 22 pounds in six months. A right salpingectomy had been done for adhesions at another institution fifteen years previously. At operation the uterus was normal. The enlarged left tube enclosed a cystic tumor mass 9 by 7 centimeters. There was a bloody fluid in the cystic mass, and the wall was lined by red granular trabeculae. The wall ranged to 2 cm. in thickness. Microscopic sections revealed villous structures like those of the Fallopian tube. The villi were on narrow fibrous stalks and covered by a many layered columnar epithelium. In some places the epithelium had ingrown the wall of the cyst and formed tubular structures. In other places there were aggregates of epithelial cells without differentiation forming papillary tubular structures. The histologic diagnosis was carcinoma of the Fallopian tube. This patient died three years later as a result of metastases.

CASE 5.—A 49-year-old para ii, with normal menses, entered St. Luke's Hospital March 24, 1935, because of a feeling of pressure in the lower abdomen for two months. She also noted that her abdomen had become larger in the three weeks prior to admission. She had lost 16 pounds in two months. At operation there was a blood-tinged fluid in the abdominal cavity. The peritoneum and the uterus were studded with small nodules. The right Fallopian tube was 1 cm. in diameter at the uterine end and increased up to 4 cm. in diameter, distally, where it formed a stalk of a large cauliflower mass 16 by 12 by 6 centimeters. There was a similar mass 14 by 10 by 9 cm. alongside. Sections of the masses were gray-yellow tissue with scalloped edges. The right tube, when opened, revealed a similar gray-yellow tissue within the lumen. Microscopic sections revealed scanty fibrous stalks covered by palisades of columnar epithelium. There were also columns of these cells apparently fused into aggregates or mosaics of cells. Other tissues had a papillary arrangement. The cells were medium in size, with vesicular nuclei, and a moderate amount of cytoplasm. Many were in mitosis. The histologic diagnosis was papillary carcinoma of the Fallopian tube.

CASE 6.—S. H., a 60-year-old nulligravida, whose last menstrual period had been five years previously, entered St. Luke's Hospital May 11, 1936, because of a hard swelling of the lower abdomen associated with a pulling aching sensation for two months. At operation the uterus was normal. The markedly thickened right tube was 12 cm. long. A cystic mass 10 by 15 cm. originated from within the dilated end of the tube. The cyst contained 400 c.c. of a dark brown fluid. The wall in places was 1 cm. thick and was lined by a gray granular tissue. The microscopic sections revealed a dense fibroblastic stroma ingrown by masses of epithelium arranged in mosaics and tubules. Along the lining of the tube were papillary folds with edematous fibrous stalks lined by a several layered epithelium. The invasion of the tissues by the ingrown masses of epithelium extended to just under the peritoneum of the tube. A subperitoneal lymph node included was composed of masses of metastatic carcinoma cells in mosaics. The histologic diagnosis was papillary carcinoma of the Fallopian tube with local lymph node metastasis.

CASE 7.—L. O., a 48-year-old single woman, whose last menstrual period had been six years previously, entered St. Luke's Hospital July 11, 1939, because of pain in the left lower abdomen of six months' duration. At operation the uterus was normal. The left Fallopian tube resembled a large pyosalpinx 20 cm. long and 8 cm. in diameter. Within the lumen at the distal end there was a mass of necrotic yellow tissue. The wall of the tube, in places, was 1.5 cm. thick. Both ovaries and the right tube were normal. Microscopic sections revealed a fibroblastic stroma extensively ingrown by large and small irregular

masses of epithelium that were arranged in mosaics. The individual cells were moderately large and had large vesicular nuclei. In some places there were tubules, and in other places there were blunt papilli with broad stalks covered by epithelium in many layers. The histologic diagnosis was carcinoma of the Fallopian tube.

Discussion

In our own detailed report, a preoperative diagnosis of carcinoma of the tube was made, although an ovarian tumor could not be ruled out. The history of postmenopausal serosanguineous discharge combined with the pelvic findings of an apparently normal uterus and cervix and a soft elongated mass in the adnexa were suggestive of tubal rather than ovarian pathology.

From our experience at St. Luke's Hospital and from a review of the literature, we feel that a positive diagnosis of primary carcinoma of the Fallopian tube cannot be made except on rare occasions, but it may be strongly suspected from the symptomatology and the pelvic findings as described above. It is difficult to rule out ovarian pathology which is more common than tubal carcinoma. At times it may be impossible to determine, microscopically, whether the primary origin of the carcinoma is in the ovary or in the tube.

References

1. McGoldrick, J. L., and Straus, H.: *Am. J. Surg.* 59: 555, 1943.
2. Martsloff, K. H.: *AM. J. OBST. & GYNEC.* 40: 804, 1940.
3. Anspach, B. M., and Hoffman, J.: *AM. J. OBST. & GYNEC.* 22: 424, 1931.
4. Dannreuther, W. T.: *AM. J. OBST. & GYNEC.* 30: 724, 1935.
5. Mitchell, R. M., and Mohler, R.: *AM. J. OBST. & GYNEC.* 50: 283, 1945.
6. Hobbs, J. E.: *South. Med. J.* 35: 733, 1942.
7. Tuta, J. A. and Stuhe, W. A.: *Am. J. Clin. Path.* 11: 864, 1941.
8. Mullinus, D. F., and Mosteller, R.: *AM. J. OBST. & GYNEC.* 45: 1042, 1943.

PREGNANCY COMPLICATED BY COARCTATION OF THE AORTA

EDMUND R. NOVAK, M.D., BALTIMORE, MD.

COARCTATION of the aorta is a rare complication of pregnancy, Mendelson, in 1941 having been able to collect only 29 cases, including three of his own. The latter three cases were seen among approximately 31,000 obstetric patients at the New York Lying-In Hospital. In Mendelson's series, the patients had an average of about three previous pregnancies each. Of the 25 women, five died during pregnancy or shortly after delivery, two from rupture of the aorta, one of cardiac failure, one of cerebral accident, and one of bacterial endocarditis. Moreover, 10 patients who survived delivery suffered a definite aggravation of cardiac symptoms as the result of the pregnancy.

In view of these findings, it is not surprising that Mendelson regards coarctation of the aorta as an exceedingly grave complication of gestation, and states firmly that any woman with this condition who comes under observation in the early months of gestation should have the pregnancy terminated. If gestation is more advanced, close observation followed by cesarean section and sterilization is his recommendation. Other observers, notably Hamilton, Walker, Eastman, and others, believe that certain of these patients can, under close supervision, be carried to full term and delivered normally. Very few persons with coarctation of the aorta live beyond 40 years, over 75 per cent of them dying of cardiovascular causes. From a theoretical viewpoint, it would certainly appear that in pregnancy the increased blood volume, cardiac output, and generally greater load would impose on these patients a severe, possibly unjustifiable strain.

In view of the fact that coarctation of the aorta is a most uncommon complication of pregnancy, and at the same time is one in which the question of therapeutic abortion will frequently arise, it would seem desirable that as many cases of this condition as possible be reported in order that the prognosis of gravidas with coarctation may be more intelligently evaluated, and the management of this condition put on a well authenticated basis. To this end the following case is reported.

Case Report

This 21-year-old white female, para 0 of Venezuelan descent, presented herself at the U. S. Naval Dispensary, Annapolis, Maryland, on January 9, 1946. Her periods had always been normal. Menses had begun at 12 years of age, occurred every thirty-one days, and were of three to four days' duration. Her last menstrual period was Oct. 19, 1945. She had always been in excellent subjective health. She had had the usual childhood diseases. While at high school in 1940 a mild hypertension was noted, although she had always been symptom-free. In subsequent years, a checkup as regards the hypertension revealed an x-ray picture typical of coarctation. Pyelograms revealed only one functioning kidney, and that there was only one kidney was confirmed in 1943 during an exploratory laparotomy, at which time her appendix was removed.

Examination of the patient revealed that she was approximately fourteen weeks pregnant, and arrangements were made to have her admitted to the hospital for a thorough study, as well as a possible interruption of the pregnancy, should the study seem to indicate this.

A fuller examination at the hospital revealed the following positive and pertinent factors. The patient was a well-developed and well-nourished individual, with no signs of dyspnea or cyanosis. The eye grounds were normal. Blood pressure in both arms was 155/80; in the right leg it was 115/60, and in the left, 120/65. The chest was clear. The heart was of normal size and shape, the sounds were of good quality, and there was regular rhythm. There was a soft substernal systolic murmur, not transmitted. There was no external evidence of an increased collateral circulation anywhere over the trunk or back. Pelvis was adequate and of a normal gynecoid type.

Various studies were made on the patient during her hospitalization. The Kahn was negative and blood counts and blood chemistry were normal. There was no albuminuria, nor was there ever any throughout the course of her pregnancy. Intravenous pyelograms showed "normal psoas and left renal shadows. Five minutes after injection of dye there was excretion on the left side, continued at 15 and 30 minutes. The left calices, pelvis, and ureter were normal. The right kidney did not visualize." The left kidney seemed to have fairly good function, the P. S. P. being 55 per cent for two hours; 35 per cent in one-half hour; 15 per cent in one hour; 5 per cent in two hours. In the dilution concentration test the urine varied from 1.003 to 1.025.

A chest plate confirmed the diagnosis of coarctation. There was definite notching of the inferior borders of the fifth to ninth ribs, consistent with the condition. The aortic arch was hypoplastic, and the cardiac silhouette within normal limits. Electrocardiogram revealed "slight left axis deviation. All complexes normal save flat T wave in lead 3." Our cardiologist interpreted the cardiogram as showing "possible myocardial damage."

It was felt that this patient could go through to term, but not without some risk, and this risk was explained to her. She was extremely anxious for the baby, and was more than willing to take the hazard which was pointed out to her. Accordingly, she was carried along watchfully, with weekly visits to the dispensary.

The course was benign for the next two months. Her pressure did not rise, the urine was negative, and there were no complaints. In March she developed an arrhythmia which persisted until term, but several electrocardiogram examinations showed only premature ventricular contractions, and little significance was attached to them.

On June 24, approximately one month before term, the pressure began to increase slowly to 170-185/100-110. The customary regime of phenobarbital, rest, salt, and fluid restriction, dietary measures, etc. was begun, and there was no further increase in pressure. It was felt that not too large a baby was desirable, and accordingly, on July 12, medical induction was attempted, but failed.

On July 22, the patient was found to have a pressure of 200/120, and she was admitted to the hospital at once. In addition she had an extremely bad severe upper respiratory infection. Because of this, surgical induction was postponed, though the membranes could have been ruptured easily. She was sedated, and the upper respiratory infection treated, preparatory to induction. Her pressure came down and remained at about 160-170/100 as the upper respiratory infection gradually improved and her temperature returned to normal. On her third day in the hospital she went into spontaneous labor, and as soon as the pains became established she was given nembutal and paraldehyde in adequate amounts. Amnesia was excellent, and the labor lasted less than ten hours.

During labor, the pressure ran as high as 230/130 in the arms, and 140/100 in the legs, but there were no sequelae. Delivery was by elective low forceps, with right mediolateral episiotomy under gas, oxygen, ether anesthesia. A normal 6 pound, 9 ounce male baby was delivered uneventfully. The postpartum course was entirely smooth and asymptomatic, marked by a gradual lowering of the pressure to 150/90, the level at which it had been noted in her first dispensary visit. She was discharged from the hospital on her ninth postpartum day, entirely symptom-free.

References

- Eastman, N. J.: Personal communication.
Hamilton, B. E., and Thompson, K. J.: *The Heart in Pregnancy and the Childbearing Age*, Boston, 1941, Little, Brown and Co.
Jensen, Julius: *The Heart in Pregnancy*, St. Louis, 1938, The C. V. Mosby Co.
Mendelson, C. L.: *AM. J. OBST. & GYNEC.* 39: 1014, 1940.
Levine, S. A.: *Clinical Heart Disease*, Philadelphia, 1940, W. B. Saunders Co.
Turino, T. R., and Wallace, J. T.: *AM. J. OBST. & GYNEC.* 45: 526, 1943.
Walker, C. W.: *Brit. M. J.* 1: 190, 1943.

Department of Reviews and Abstracts

Selected Abstracts

Gynecology

Paris, 1946: The Disturbances of Ovulation, Proceedings of the 10th French Congress of Gynecology, May, 27-29, 1946.

The proceedings of the Tenth French Congress of Gynecology is entitled "Disturbances of Ovulation." This meeting was held at Lyon, May 27 to 29, 1946, and the seven papers presented at that time are contained in this 164-page proceedings.

G. Dubreuil Bordeaux discusses the histophysiologic and morphologic aspects of the ovary in terms of recent investigative work. This first paper, of French Congress, reviews in considerable detail the microanatomy of the ovary describing in order the evolutionary, degenerative, and involution cytohistologic changes. Each of these representative findings are discussed separately in the categories of the control zone, the undulatory zone, and the ovarian epithelia. He concludes with a description of the various types of ovaries, viz: the embryonic, fetal, infantile, prepubertal, and pubertal types. He distinguishes the ovary of the early adult sex activity from that of late sex activity; the changes which are found in the premenopausal to menopausal period, and the postmenopausal ovary to the fully senile organ.

R. Moricard, of the Broca Hospital's Gynecology Clinic and Postgraduate School's Endocrine Laboratory in Paris, considers "the mechanisms of ovulation and the standardization of gonadotropins." He divides his discussion into three main parts: (1) a historical review of the physiology of ovulation, (2) the quantitative standardization of endocrines in rodents as based upon the 1939 International Standards, and (3) the methods for the dosage determination of gonadotropins essential to induce ovulation in the primates and woman. The author admits this third problem is far from resolution, although it is his opinion that experimental work seems to indicate that the injection of serum gonadotropins is inclined to produce greater regularity of ovulation in woman than the use of chorionic pituitary gonadotropins.

Raoul Palmer, of Broca Hospital, Paris, presented an interesting third paper entitled "Tests for Ovulation in Woman." In the category of true tests of ovulation the author considers the recovery of ova or concepti at time of laparotomy, impregnation following single exposure, and conception following application of the Ogino-Knaus method of calculating the time of ovulation. The author reviews many of the usual methods used to determine ovulation, including: clinical signs; vaginal biopsies and smears; cervical tests concerned with viscosity changes of the mucus, its pH and refractive index; endometrial biopsy; the uterine muscular tests of Knaus, Varangot, and his own; the hormonal tests concerned with total estrogens, fractional estrogens, urinary pregnandiol excretion, and blood levels, along with the chemical tests of Takata and Domoto and Samuels. He adds a full review of potentiometric methods and basal body temperature. Palmer concludes by listing the criteria of ovulation evidence in order of descending value as a diagnostic method: (1) intermenstrual crisis, (2) intermenstrual spotting, (3) cervical mucus changes in viscosity, (4) basal body temperature, (5) glycogenic activity in secretory endometrium, (6) the vaginal smear, (7) the bio-assays of urinary steroids, and (8) the potentiometric study.

M. E. Gueissaz, of Neuchatel, reports on the topic of: The Intermenstrual Crisis. This author concludes by redescribing the typical syndrome associated with rupture of the follicle. He states that the symptomatology varies because the co-existent utero-adnexal conditions vary, and that other known and accepted criteria of ovulation show a close correlation to this intermenstrual crisis syndrome.

Wm. J. A. Schockaert and J. Ferin, of Louvain, next considered the role of disturbances of ovulation in gynecologic pathology. They define several new terms not usually considered in this country: (1) eu-ovulation, indicating a normal rupture of the follicle, (2) dysovulation, connoting follicular rupture without extrusion of the ovum or with the expulsion of an immature ovum, (3) paraovulation, denoting ovulation occurring at other than anticipated times as in the course of the folliculino-progestin phase. These authors emphasize the role of anovulation to gynecologic pathology as seen in menstrual disorders, and conclude that our knowledge and evidence indicating the etiologic factors of anovulation are "very fragmentary and often contradictory."

M. J. Figarella, of Marseille, the second from the last speaker at the Tenth French Congress on Gynecology, considered "the hemorrhages of follicular origin." He divided his subject into four main parts following an historical review; (1) the clinical problem, in that more than half of these cases occur in adolescent girls and that more than four-fifths of all these cases occur in women before the age of 30 years; (2) the diagnostic problem which he considered not difficult, and proceeded to list four cardinal and four secondary diagnostic signs; (3) the biologic problem, concerned principally with evaluation of pathogenetic hypotheses; and (4) the therapeutic problem. Therapy was the preventive and curative methods. For the former no definite suggestion is made. The cure is obtained practically always by surgery which should be extremely conservative—usually suture of the bleeding point with or without enucleation and partial resection.

M. G. Cotte, of Lyon, gave the final paper. Its title was "The Treatment of the Disturbances of Ovulation." Under medical therapy the author mentioned the use of yohimbine and prostigmin, but he concludes neither exerted direct action upon the ovulation process. He considered the various gonadotropins; touched briefly upon vitamins, A, B, C, D, and E, stressing the latter's value in infertility, and commenting he had obtained fair results in several cases exhibiting metrorrhagia, using intravenous vitamin C. Hydrotherapy, diathermy, and roentgen-ray therapy were considered, but the latter was not recommended. The author concludes with detailed evaluation of the usual and numerous surgical means used to control menstrual abnormalities.

This volume, "Disturbances of Ovulation" adds no new knowledge to our present understanding of this difficult subject. It is valuable in that it: (1) makes available excellent summarization of these problems, and (2) one can review most of the French literature on this topic in a single volume.

C. E. FOLSOME.

Vara, Paavo, and Pankamaa, Paavo: A Clinical-Statistical Investigation of Ovarian Tumors Operated at the Helsinki University Clinic of Gynecology During the Years 1900-1944, Acta obst. et gynec. Scandinav. 26: 1-78, Supplement 4, 1946.

The authors, Vara and Pankamaa, present an exhaustive and monographic summary, in eight chapters contained in this supplement, on a survey of ovarian tumors collected in Finland over a period of forty-four years. The survey material of 1,149 surgically treated tumors was collected from 33 years' experience at Helsinki University Gynecology Clinic and eleven years' experience at the Second Women's Clinic in the same school. Their excellent survey is entirely in English, and will provide an excellent comparative study data, particularly so since the authors completely reviewed the data in light of Miller's classification of tumors.

There were 37,811 total gynecologic cases treated in the above hospital, giving 1,149 ovarian tumors, an incidence of 3.04 per cent. There were 11,044 gynecologic operative cases, hence an incidence of 10.44 per cent of Finnish gynecic surgical cases exhibited ovarian tumors.

There were 48 (4.18 per cent) connective tissue tumors, of which nine cases (19 per cent) were malignant. There were 565 epithelial tumors (49.17 per cent) of which 221 cases (39.1 per cent) were malignant. Teratoid growths numbered 536, or 46.65 per cent, of which only 1.1 per cent were malignant. The benign tumors totaled 901 cases, 78.41 per cent; and the malignant 248, or 21.59 per cent.

The writers report that the most common ovarian tumor was the pseudomucinous cystoma, 322 cases, or 28.02 per cent. The second tumor in frequency rank was smooth-surfaced serous cystadenomas, 259 cases, or 22.54 per cent. Other ovarian tumors with a frequency greater than 10 per cent of the whole included dermoid cysts (208 cases, or 18.1 per cent) and primary carcinoma of the ovary (182 cases, or 15.8 per cent). The remaining types are listed in considerably detailed tables. Among the rarer ovarian tumors were four teratoma ovarii, 16 granulosa-cell tumors, four Brenner cell tumors, two myofibromas, one hypernephroma ovarii, and seventeen cases of pseudomyxoma peritonei, 148 per cent.

Most carcinomatous degeneration occurred in papillary cystadenomas, 37.9 per cent. The youngest case was aged 9 years, and the eldest, 79 years. Fifty per cent of the ovarian tumors were found in patients between the ages of 30 to 49 years, 25 per cent between 30 to 39 years, and 24.8 per cent between 40 to 49 years. The menarche average age was 15.46 years, which corresponds to average age of Finnish women. The authors' section on relation of ovarian tumors to fertility is excellently documented. They noted that the number of married cases, of their ovarian tumor series, reported as childless, was 122, or 15.66 per cent, which compares to 16.8 per cent of over-all childless marriages, after a duration of three years, as learned from the Finnish Central Statistical Bureau—indicating childlessness is not more frequent among ovarian tumor patients. The fertility index of patients who had given birth to children was 3.74 children average. It was not possible to demonstrate any different incidence of ovarian tumors in married or single patients. However, in certain tumor categories, some considerable differences were seen—in the primary carcinomas group the sterility incidence was 22.1 per cent, in secondary carcinomas 21 per cent, in dermoid cysts 15.9 per cent, in serous cystadenomas 14.9 per cent, in pseudomucinous cystomas 13.9 per cent, and in connective tissue tumors 8.1 per cent.

These usual ovarian tumors varied from fist to head size. Eighty-one per cent of the giant size tumors were pseudomucinous cystomas. In the largest tumor of the series 51 liters of pseudomucinous fluid were withdrawn. The bilateral frequency of all ovarian tumors was 14.62 per cent; present in 9.7 per cent of the benign tumors, and 32.7 per cent of the malignant growths. In the whole series 7.39 per cent of the tumors were intraligamentous. Torsion, as a complication was present in 16.27 per cent of all cases, and in increased frequency in cases under 20 years of age and over 60 years of age. As a result of torsion, hemorrhage was present in 15.5 per cent, necrosis in 15 per cent, perforation in 2.9 per cent, and blood-stained fluid in the abdominal cavity in 3.2 per cent of the cases. Infection or suppuration was present in 1.74 per cent of all cases.

The treatment in this large series of 1,149 cases of ovarian tumors was surgical and selective for the type of tumor. Tables list the various combinations of oophorectomy, salpingo-oophorectomy with or without hysterectomy and associated intestinal surgery. The over-all primary mortality was 3.74 per cent. The greatest mortality was in carcinoma ovarii cases (11.3 per cent) of which 18 per cent were secondary and 10.4 per cent primary, and the lowest mortality in the dermoid cyst cases, 0.5 per cent. The mortality among benign tumor patients was 2.1 per cent, and that among the malignant 11.2 per cent. It was highest in exploratory laparotomy cases (13.0 per cent), and lowest (2.2 per cent) in those cases having unilateral or bilateral oophorectomy.

Fatal complications included cardiovascular accidents, 1.71 per cent; peritonitis, 0.78 per cent; pneumonia, 0.61 per cent; ileus, 0.35 per cent, and meningitis and nephrosis each 0.09 per cent.

The authors submit no follow-up beyond the close of the first hospital discharge. Their data is superbly documented in 12 well-arranged statistical tables and one graph.

C. E. FOLSOME.

Teilum, Gunnar: Arrhenoblastoma—Androblastoma. Homologous Ovarian and Testicular Tumors. II. Including the So-called "Luteomas" and "Adrenal Tumors" of the Ovary and the Interstitial Cell Tumors of the Testis, Acta path. et Microbiol. Scand. 23: 252-264, 1946.

The author, of Copenhagen, details a case of a feminizing testicular tumor occurring in a 53-year-old male. The tumor has been present for thirty years, and increased in growth

during the past two years. In the past three years there had been impotence and, during the last year, increasing gynecomastia. The latter finding subsided postoperatively.

Teilum suggests that for the ease of survey and comparison, the homologous tumor series may be arranged in tabular order with similar but nonhomologous tumors belonging to the granulosa-cell group.

Under the category of homologous tumors of his androma series (arrhenoblastoma), he lists those found in the testis and the virilizing mesenchymomas of the ovary in two lists. The testis group include the androma (arrhenoblastoma), and the differentiated (tubular), intermediate and diffuse varieties. Variants of this group include the androma lipoides, of the tubular and diffuse types, and the "interstitial cell tumor." The virilizing ovarian group (mesenchyoma) includes the arrhenoma (arrhenoblastoma) and the differentiated (tubular), intermediate, and diffuse varieties. Variants of this group include arrhenoma lipoides of the tubular and diffuse types, tumors previously described as "adrenal tumors," "luteoma," "masculine ovoblastoma," and the "extraglandular" interstitial cell tumor.

Teilum compares the above two main groups with the granulosa-cell tumors, feminizing ovarian mesenchymomas as—granulosa-cell tumors of the differentiated, intermediate, and diffuse types and, as a variant of this group, the luteinized granulosa-cell tumor, thecoma.

The author, in a letter to Dr. Kosmak accompanying his reprints, stresses that he is of the opinion that his recommendations afford a more exact histogenetic classification comprising both ovarian and testicular tumors. His data is exceedingly well documented and illustrated with 14 photomicrographs and four tables. It does represent one of the most lucid classifications of these complex tumors that have come to the attention of oncologic students.

C. E. FOLSOME.

Gynecologic Operations

Stamer, S.: Partial and Total Atresia of the Uterus After Exochleation, Acta obst. et Gynec. Scandnav. 26: 263-297, 1946.

Stamer reports his findings on 24 cases of uterine atresia of several types, following exochleation from the First Gynecological Division of Rigshospital, Copenhagen. The term atresia is defined in this article as partial or total, indicates closure of the uterine cavity or cervical canal. Exochleation is not defined, but strong inferences in the paper suggest it connotes almost complete epithelial denudation of the endometrium and/or cervical spindle epithelium.

The writer collects and details 37 cases from the literature and adds 24 cases from his institution. He finds the age of the patient not significant. In all 24 of the author's series the atresia was preceded by vigorous curettages of the puerperal uteri; and reported in non-puerperal uteri in only four of 37 cases in the literature series. There were six cases of total atresia, one from literature and five in the series studied by the author. Total atresia, with complete absence of endometrium, is practically symptom-free—save for amenorrhea.

Partial atresia is more often localized to the internal os; with symptoms of periodic pain and amenorrhea. The duration of the atresia seems to exert no harmful effect upon the endometrium, and normal menses are nearly always established after abolition of the atresia—in one case up to six years.

The usual therapy includes only dilatation procedures, although the author reviews many older surgical methods. In all the cases reported by the writer, every patient had experienced energetic curettage in other hospitals and came to Rigshospital because of symptoms of periodic pain and/or amenorrhea.

C. E. FOLSOME.

Davis, James E., and Cheek, David B.: Bleeding From the Cervix After Subtotal Hysterectomy, J. A. M. A. 131: 816, 1946.

The authors made a survey of the postmenopausal bleeding in their clinic covering a period of seven years. Eighty-seven cases of cervical stump bleeding were uncovered. Of this group 40 patients, or 46 per cent, were found to have a cervical cancer, and of these

40, there were 6, or 15 per cent, who had a benign-appearing cervix at the time they were first seen complaining of bleeding. The authors are of the opinion that every patient who has vaginal bleeding at any time after a subtotal hysterectomy deserves a biopsy of the cervix and a gentle curettage of the cervical canal.

WM. BERMAN.

Young, Jr., John P., and Cole, Warren H.: Intraperitoneal Administration of Succinylsulfathiazole and Phthalylsulfathiazole, Arch. Surg. 53: 182, 1946.

The introduction of the oral use of succinylsulfathiazole and phthalylsulfathiazole as antibiotics for bacteria in the intestinal tract in colonic surgery by previous workers led the authors to investigate the absorbability of these drugs when they were introduced intraperitoneally. Experiments performed by them on dogs and humans revealed the fact that they were absorbed rapidly from the peritoneal cavity, although they were taken up only slightly when given by mouth. They also investigated the action of these drugs upon certain bacteria isolated from cases of peritonitis. They state that, although streptococci and other pyogenic bacteria are occasionally isolated, causative organisms in peritonitis, *Escheria coli*, is much commoner and, even when a mixed infection occurs, it is usually the predominant organism. Since both of these drugs are known to be extremely effective in reducing *Escheria coli* count of the stool, when given orally, the authors feel it is reasonable to suppose they would also be effective against the same organism in the peritoneum. They cite two cases in particular of their series of 51 cases where the drugs were given intraperitoneally, that substantiate this opinion. In each case, *Escheria coli* disappeared from the peritoneal cavity following implantation of phthalylsulfathiazole, although the other organisms were still present on the culture. In 28 patients of the series, succinylsulfathiazole was used, while on 23 cases phthalylsulfathiazole was injected intraperitoneally. The drug was either dusted in as a powder, or suspended in 20 to 30 c.c. of normal saline and poured into the peritoneal cavity. They advise that care should be taken lest the drugs get into the wound. Their presence in the wound will delay healing. The patients were watched closely postoperatively, but no toxic reactions were noted.

E. C. HUGHES.

Tyrone, C. H., Collins, C. G., Weed, J. C., Zeigler, R. F., Jr., and Crawford, J. B.: Hysterectomy—A Study of 607 Cases, South. M. J. 39: 957, 1946.

Experience with hysterectomy is reviewed in a series of 607 cases of which there were 478 total abdominal, 100 vaginal, and 29 subtotal hysterectomies. The symptom most frequently seen was vaginal discharge. Pelvic pain and backache, hypermenorrhea, and polymenorrhea commonly associated with dysmenorrhea were observed in the abdominal group. It is interesting to note that 28 per cent of the group gave history of absolute sterility.

Pathologically, 44 per cent of the uteri showed leiomyoma. Endometriosis was present in 20 per cent, and malignancy in 8.2 per cent.

The morbidity rate based on a temperature of 100.4° F. on two consecutive days was 22.4 per cent for total hysterectomy group, 20.7 per cent for subtotal group, and 56 per cent for vaginal hysterectomies.

WILLIAM BICKERS.

Menstruation

Viggiano, F. A.: Dysmenorrhea in Industry. Treatment With a New Antispasmodic, Indust. Med. 15: 632-635, 1946.

Viggiano stresses the significance of dysmenorrhea as the most common cause of absenteeism and inefficiency among employed women, responsible for an average loss of two or more work days per month for each such employee.

The author became impressed with the results obtained from treatment of 112 dysmenorrheic patients treated at the Dispensary of the School of Aeronautics, June 1 to August 26, 1943, with pavatrine (beta-diethyl-aminoethyl fluorene-9-carboxylate hydrochloride), an ester

of an amino alcohol and an organic acid. He added recently to this first group a second group of 109 patients seen at the Harrisburg Shops' dispensary. The total group of 221 patients were given in all 243 courses, consisting in the main of a single dose of two tablets (0.25 Gm.) and an hour of bed rest.

The author concluded that pavatrine was safe and effective. Its use reduced absenteeism. In the whole series, 89.3 per cent of the treatments enabled the patients to return to work during the same day, and 76.6 per cent returned to work within one hour; full activity was possible in 51.5 per cent, and slight modification of activity in 25.1 per cent. The author compared results of pavatrine to another antispasmodic (tropic acid ester) in a third series of 128 cases, and obtained 76.6 per cent from the former and 64 per cent upon the latter. It is noteworthy that the degree of relief, however, was as follows: complete relief, 55.9 per cent; moderate relief, 19.1 per cent; slight or no relief in the remaining 25.0 per cent among the group of cases, aged 25 to 41 years.

It is unfortunate that the author failed to classify and correlate the degree of menstrual pain to therapy, and limited himself to the correlation of only the types of therapeutic relief. Furthermore, his article loses much significance in that he failed to include proper control series treated by placebo or suggestion.

C. E. FOLSOME.

Grant, Alan: Profuse or Irregular Menstrual Periods in Young Women: A Practical Programme of Treatment, M. J. Australia 113: 1946.

The author adopted the following standards before a case was designated as one of functional hemorrhage:

1. The hemoglobin value must be 80 per cent or less;
2. The menstrual periods must last longer than seven days;
3. The menstrual periods must occur at intervals of less than twenty-one days;
4. The diagnosis must be supported by diagnostic curettage. The curettage may be carried out in many cases with endometrial biopsy curette. In this series of cases, 66 per cent of the cases showed evidence of a hyperplastic endometrium, and a further 22 per cent showed abnormalities such as irregular ripening of the endometrium or hyposecretory changes or atrophy.

In many cases the curettage alone establishes a normal cycle. In cases where the patient is distressed by curettage, a 10-day course of cyclic therapy (stilbestrol and progesterone) is given. In cases where emergency treatment was necessary, the author used either curettage, large doses of estrogen, or intrauterine packing with gauze and drugs.

The author reviews the more standard methods of treatment at use during the present time.

WILLIAM BERMAN.

Parella, Dominick: Further Observations on Prostigmine in Delayed Menstruation and Pregnancy, West. J. Surg. 54: 397, 1946.

Vasodilatation in the endometrium induced by estrogen results from the liberation of acetylcholine. It was postulated that amenorrhea may be the result of a deficiency in acetylcholine. Prostigmine neutralizes the choline esterase permitting the available acetylcholine to function, thus inducing a hyperemia and menstruation.

Prostigmine was administered to 200 patients with amenorrhea. Uterine bleeding did not occur in amenorrhea due to pregnancy, endocrine disturbances, or the menopause. In all others except 6 cases, uterine bleeding occurred within seventy-two hours of completing the three-day course of injections.

Fredrikson, Herbert: The Role of the Thyroid in Certain Menstrual Disorders, Acta obst. et gynec. Scandinav. 26: 11-40, 1946.

Fredrikson, of Sundsvall, Sweden, reports in considerable detail his experience with nine selected cases of menstrual disorder either caused by or associated with a hypothyroid status.

All the cases cited exhibited hyper- or polymenorrhea, four of whom were biopsied and were revealed to have hyperplasia of the endometrium. Thyroid with or without iron constituted the therapy with good results in all nine cases. There are nine photomicrographs and one table in the article.

C. E. FOLSOME.

Pillay, A. P.: The Vitamin C Test for Ovulation, Indian M. Gaz. 75: 91, 1940; 75: 668, 1940; 77: 279, 1942.

More and more methods are being suggested for determining the day of ovulation in the menstrual cycles of women. Most of them seem to have some drawback, and others can be carried out only by doctors with special training. In this paper is described a test which can be carried out even by general practitioners.

The test used is a modification of the one used by Tillman to detect vitamin C deficiency in the system, and is based on the fact that vitamin C in excess of the requirements of the body is promptly excreted in the urine. For this any existing deficiency in the system must be corrected by administering vitamin C to the woman. The dose depends on vitamin C containing articles in the usual diet of the person, i.e., on her income group; 150 to 200 mg. appears to be the usual dose required.

One tablet of dichlor-phenol-endo-phenol (Roche) is dissolved in 50 c.c. of water. Five c.c. of the solution are pipetted into a beaker. Freshly voided urine is titrated quickly into this solution from a burette, and the quantity required to decolorize immediately the blue of this solution gives the quantity of vitamin C present in the sample of urine. Vitamin C reduces the dye dichlor-phenol-endo-phenol to its colorless leuco-derivative. The test should be completed within two minutes after the urine is passed. The result is charted on graph paper.

It will be noticed that vitamin C excreted will be lowest on the day of ovulation, i.e., the quantity of urine required to decolorize the dye solution will be largest. This means that a marked upward curve will be noticed on that day. In anovulatory cycles, there will not be any pronounced curve, while in multiovular cycles, there will be more than one. The urine of men does not show any such variation in the excretion of vitamin C. In the graphs, the vertical figures indicate the quantity of urine in cubic centimeters required to decolorize 5 c.c. of the dye solution, and the horizontal figures the days of the menstrual cycle.

Though the test is carried out only from the day the menstrual flow stops, vitamin C is administered daily from the *first day* of the flow to correct vitamin C deficiency which is almost always present. The test has to be carried out daily in the first cycle as an exploratory measure, and in subsequent cycles it need be done only from the fifth to one or two days after the ovulation cure has been noticed.

It is advisable to carry out the test at the same hour every day to avoid upsets due to dietetic variations. The chief fallacy in the test is that if large quantities of water are drunk, the urine will be diluted and the curve will be upset. This should be forbidden. The test described may be varied by determining the actual quantity of vitamin C present in the urine. This is arrived at by dividing 10 by the quantity in c.c. of the urine required to decolorize 5 c.c. of the dye solution, which is equivalent to 0.1 mg. of vitamin C. In this modified test, the graph will show a reverse picture, i.e., the curve will be lowest on the day of ovulation. Other interesting findings were:

1. During the luteal phase of the menstrual cycle, the excretion of vitamin C in the urine is higher than during the follicular phase.
2. There is vast difference in the amount of vitamin C excreted in the urine when progesterone and estrin are administered, large quantities being excreted during progesterone administration and smaller quantities during estrin administration.
3. Vitamin C excretion in the urine is consistently high in cases of early pregnancy and in incomplete abortions.

A. P. PILLAY.

Miscellaneous

Ensor, Charles R.: The Electrocardiogram of Rats on Vitamin E. Deficiency, Am. J. Physiol. 147: 477-480, 1946.

The author sought to evaluate the conflicting evidence in the literature concerned with the influence of vitamin E deficiency upon cardiac musculature. Five separate groups of patients were placed upon E-deficiency diets, including males and females in each series, and electrocardiograms were taken at intervals for a one-year period.

The author concluded that the electrocardiograms maintained for one year on an E-deficient diet was not different from electrocardiograms of normal rats, save possibly a slight exception—in one-third of one group there was a slight widening of the QRS complex.

C. E. FOLSOME.

Fordes, Thomas R.: The Origin of Freemartin, Bull. Hist. Med. 20: 461, 1946.

The author goes into considerable detail in discussing the origin of the word "freemartin." He states that the etiology of this word has never been fully established, but that it most certainly comes from nonclassical sources and did not have its origin in Latin or Greek. He, however, brings attention to the statement of John Hunter who first published on the phenomena of freemartin, and who stated that the Romans did have the female gender of the word "taura" to mean a bull which was nonfertile. The word "martin" apparently appears in writings from England and Scotland as early as 1220, and is apparently used to mean a cow or an ox or a spade heifer. There are several hypotheses regarding the origin of the word "free." The author suggests one possibility, namely that "free" may have had its origin from the Anglo-Saxon word "fearr" or "fear," meaning a bull or an ox. On this basis the author offers the hypothesis that freemartin may have signified an ox-like or bull-like cow just as the Roman word taura (feminine) may have indicated a female bull. "If freemartin and taura indeed had such meanings, then it is of course necessary to assume that at the times these terms came into use cattle raisers recognized that such animals possessed some essential sexual characteristics of both sexes." The author feels that this assumption seems not unwarranted.

L. M. HELLMAN.

Newborn

Hill, J. M., and Haberman, Sol: Demonstration of Rh Antibodies in the Newborn and Further Evidence of the Pathogenesis of Erythroblastosis, J. Lab. & Clin. Med. 31: 1053-1066, 1946.

Hill and Haberman, of Dallas, offer additional evidence which tends to establish certain steps in the pathogenesis of erythroblastosis. They describe three varieties of Rh antibodies—agglutinating, blocking, and developing—found in both the newborn and the mother. The authors submit evidence that the Rh antibody acts as a hemolysin in vitro.

A careful analysis of 10 cases of erythroblastosis showed a relatively good correlation between the severity of the disease and antibody titer by the developing test. Therapy results indicated the advisability of immediate and adequate transfusion of Rh-negative blood in hemolytic disease of the newborn. The writers state breast feeding is contraindicated when Rh antibodies can be demonstrated in the maternal or fetal serum or adsorbed on fetal erythrocytes.

The authors conclude that the developing test as applied to the demonstration of adsorbed antibodies on fetal erythrocytes is a possible diagnostic test for erythroblastosis.

C. E. FOLSOME.

Barron, Donald H.: The Oxygen Pressure Gradient Between the Maternal and Fetal Blood in Pregnant Sheep, Yale J. Biol. & Med. 19: 23-27, 1946.

Barron, of Yale, observed that the oxygen pressure gradient across the placenta increases as gestation advances. The oxygen pressures in the fetal umbilical artery, umbilical

vein, the uterine artery, and uterine vein of the cotyledonary sheep placenta. These values indicated that during the nine periods of observation (81, 86, 97, 107, 110, 113, 126, 132, and 147 days of fetal age), the pressure gradient favored the movement of oxygen from the maternal to the fetal blood while the average pressure differences increased from 11 mm. Hg at 80 days to 57 mm. at 147 days.

It is unfortunate that more human data of this type are not collected at the time of hysterotomies and cesarean sections, under local anesthetics, and compiled. It might contribute much to further understandings on fetal anoxemias.

C. E. FOLSOME.

Traut, Herbert F.: Hypoxemia of the Fetus, West. J. Surg. 54: 379, 1946.

The fetal blood in utero has a progressive drop in oxygen saturation from 50 per cent at seven months to 28 per cent at term. The stress of labor, analgesic drugs, and separation of the placenta places the fetus in a state of further oxygen want. The human placenta must provide from a single blood lake transfer of salts, sugars, gases, and amino acids. As term approaches, more amino acids are required, these pass slowly through the chorionic villus, and so circulation through the placental lake becomes slow and sluggish to permit time for amino acid absorption. This retarded circulation reduces oxygen exchange. This handicap is partially compensated for by an increased number of fetal red blood cells, increased capacity of fetal hemoglobin to carry oxygen, and by shedding of the Langhan cells to permit closer proximity of the fetal to maternal blood. Such a delicate mechanism is easily disturbed. Deterioration of the cerebral cortex follows oxygen want. In a study of 132 children who had suffered hypoxemia during labor it was found that 97 suffered alterations in behavior later in life and the other 35 showed subnormal intelligence, locomotor difficulties, and epilepsy. Administration of oxygen to the mother during labor is recommended wherever conditions arise that will contribute to the hypoxemia of the fetus.

WILLIAM BICKERS.

Tyson, Ralph M.: A Fifteen-Year Study of Prematurity From the Standpoint of Incidence, Mortality, and Survival, J. Pediat. 28: 648, 1946.

This report consists of a fifteen-year clinical and statistical study of premature infants born in the Philadelphia Lying-In Hospital, a branch of the Pennsylvania Hospital.

Only a slight annual fluctuation in the occurrence of premature babies was evident and it could not be proved that age, race, and economic factors were determining factors, whereas there was some reason to believe that competent prenatal care, together with faithful co-operation of the pregnant woman, produced a favorable response.

The survival of premature infants seems to be primarily dependent upon their birth weight, the absence of severe complications before and during delivery, and skilful care during the first few weeks of life. The cautious administration of food, the avoidance of dehydration and infection, and the maintenance of a favorable environment are discussed.

JAMES P. MARR.

Glynn, Martin J.: Treatment of Epidemic Diarrhea of the Newborn, J. Pediat. 29: 205, 1946.

The author reports 91 full-term and 92 premature infants under four weeks of age treated by a specific regimen, which is carefully outlined. Of the full-term infants, the mortality was 13 per cent. Among the premature infants, the rate was 17 per cent.

JAMES P. MARR.

Jacobi, Mendel, Litvak, Abraham, and Gruber, Seymour: The Influence of Human Serum Albumin on Edema in Erythroblastosis Fetalis, J. Pediat. 29: 177, 1946.

The authors report two patients with erythroblastosis fetalis complicated by severe generalized edema successfully treated with concentrated human serum albumin.

It is postulated that liver damage, frequently a feature in severe erythroblastosis fetalis, with a disturbed blood protein level was the causative mechanism of the edema and that the serum albumin restored the level.

JAMES P. MARR.

Aldrich, C. Anderson, and Holmes, Carl A.: Treatment of Impetigo Neonatorum With Minimal Doses of Penicillin, Am. J. Dis. Child. 72: 279, 1946.

The authors report a series of ten infants with impetigo seen among the newly born babies in the obstetric nursery at St. Mary's Hospital, Rochester, Minn.

The routine treatment now given such infants consists of two doses of 5,000 units each at a three-hour interval as soon as the diagnosis is made.

These babies are returned to the original nursery after thirty-six hours of the beginning of treatment. No spread to other babies has occurred.

JAMES P. MARR.

Slobody, Lawrence B., Benson, Ruel A., and Mestern, Joan: A Comparison of the Vitamin C in Mothers and Their Newborn Infants, J. Pediat. 29: 41, 1946.

The authors report 77 mothers and their newborn infants tested with an intradermal test for vitamin C.

The newborn infant tends toward vitamin C saturation, even if it must deplete the mother. Their ability to do so is as yet unexplained. The authors advance several suggestions as possible sources.

JAMES P. MARR.

Brown, Estelle W., Lyon, Robert A., and Anderson, Nina A.: Causes of Prematurity. VII. Influence of Uterine Bleeding on the Incidence of Prematurity, Am. J. Dis. Child. 71: 482, 1946.

This study is based on the records of 13,329 mothers and infants, and the separate groups of mothers suffering from different types of bleeding are large enough to permit statistical evaluation of the data.

The offspring of those with placenta previa was 30 per cent. In the offspring of those with premature separation of the placenta the rate was 53 per cent. In the offspring of those who had only the mildest form of bleeding the rate was 14 per cent.

The occurrence of other illnesses, such as toxemia of pregnancy or syphilis, together with bleeding, did not increase the incidence of prematurity above the levels associated with bleeding alone.

These rates were in distinct contrast to that of 7 per cent, the rate of premature deliveries by the group of women who had no symptoms of bleeding throughout pregnancy.

JAMES P. MARR.

Holmes, Arthur D., Kuzmeski, John W., Lindquist, Harry G., and Rodman, Henry B.: Goat's Milk as a Source of Bone-Building Minerals for Infant Feeding, Am. J. Dis. Child. 71: 647, 1946.

Twenty-four samples of goat's milk were assayed for calcium, magnesium, potassium, phosphorus, fat, and nitrogen. The values obtained were calcium, 137 mg. per hundred grams; magnesium, 17 mg.; potassium, 170 mg.; and phosphorus 112 mg.; fat 4.4 per cent; and protein, 3.4 per cent.

While goat's milk is shown to be a rich source of minerals for infants, a final appraisal of its true value as a source of bone-building minerals for infant feeding must await data regarding the extent to which infants can utilize the minerals supplied by goat's milk.

JAMES P. MARR.

Correspondence

Oil Embolism From Hysterosalpingography

To the Editor:

The frequency of accumulating reports of oil emboli, fatal and otherwise, following the injection of iodized oil for hysterosalpingography is alarming and serious, particularly because this accident is almost entirely uncalled for.

The latest of these occur in the article by Ingersoll and Robbins¹ in the February (1947) issue of this JOURNAL. T. R. Hannon of Houston, Texas, has recently sent me reports of two similar cases about which he was consulted. One was fatal.

In the first place, altogether too many hysterosalpingographies are being performed. This procedure should not be substituted, as so many do, for tubal insufflation (the Rubin test), but should be restricted to those patients in whom the desired information cannot be obtained by the Rubin test.

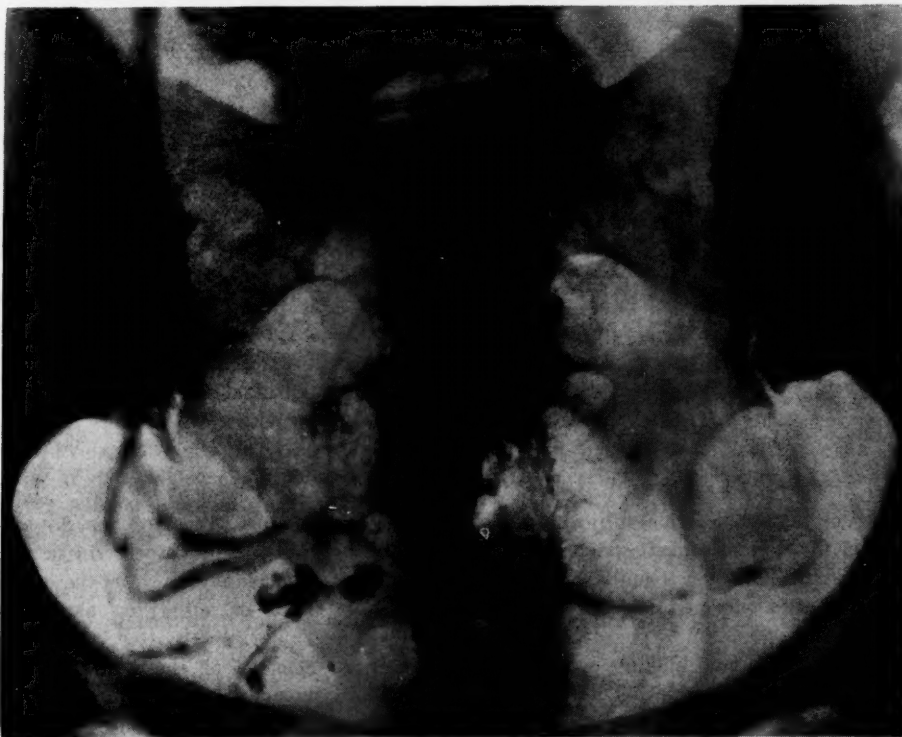


Fig. 1.—Hysterosalpingography with iodized oil embolism. Pelvic veins invaded, probably through back pressure against obstructed tubes. Screw-tip cannula may damage endocervix or endometrium making point of entry into veins. (Courtesy T. R. Hannon, M.D.)

Secondly, iodized oil should not be used as the opaque medium because it is a foreign body remaining as such wherever it is injected. It is not absorbed and eliminated, but remains encysted within the pelvis when passed through the tubes, or becomes a highly dangerous embolic agent if accidentally injected into a vein. Moreover, it is likely to act as a chemical irritant of the tubes in persons sensitive either to iodine, or to its vehicle, the poppy-seed oil.

As long ago as 1937, our Pittsburgh group recognized these dangers, developed, and announced a nonirritating opaque medium for hysterosalpingography named Skiodan-acacia (Winthrop²⁻⁴). Both the skiodan and its vehicle, acacia solution, are completely eliminated from the body, thus not having a foreign body effect, and so rapidly does this solution disappear that the serial x-ray pictures must be taken immediately and in close sequence after injection. Accidentally injected into a vein, its elimination through the kidneys (skiodan) and the liver and bowel (acacia) would proceed so rapidly as to offset the likelihood of embolic effect. So far as I know, there has been no case of fatal pulmonary embolism reported after the use of this absorbable medium.

The third item in avoidance of such an accident is proper technique. As Ingersoll and Patterson point out, (a) hysterosalpingography should not be attempted within eight days after cessation of menses, (b) or after a curettage; (c) a short blunt tip should be used (or the soft flexible Hyam's tip). I would add that screw-thread tips are especially to be avoided, and (d) that the fractional injections according to Hyam's technique should be utilized. This is marked by serial injections of 3 c.c. each for a total of 9 c.c. with an x-ray picture after each 3 c.c. The advantages of this technique are many and so familiar that they do not need to be recounted. The likelihood of intravasation is lessened by this method as contrasted with a single forcible injection to full uterine capacity (9 to 10 c.c.).

To recapitulate, judgment in selection of cases and proper technique should eliminate this gynecologic hazard.

PAUL TITUS, M.D.

1015 HIGHLAND BLDG.,
PITTSBURGH, PA.
MARCH 28, 1947

References

1. Ingersoll, F. M., and Robbins, L. L.: AM. J. OBST. & GYNEC. 53: 307, 1947.
2. Titus, P., Tafel, R. E., McClellan, R. H., and Messer, F. C.: AM. J. OBST. & GYNEC. 33: 164, 1937.
3. Titus, P., Tafel, R. E., McClellan, R. H., and Messer, F. C.: AM. J. OBST. & GYNEC. 36: 889, 1938.
4. Titus, P., Tafel, R. E., McClellan, R. H., and Messer, F. C.: AM. J. OBST. & GYNEC. 37: 495, 1939.

Curare in Dysmenorrhea

To the Editor:

In my article on this subject, published in the April, 1946, issue of the JOURNAL, I misstated the dosage of Intocostrin employed. The correct dosage of Intocostrin or solution d-tubocurarine chloride, (Squibb), used by Dr. Danielson and myself for the relief of dysmenorrhea is one half to one c.c. and not 50 to 100 units or milligrams as incorrectly stated by me.

Abbotts are now making a solution d-tubocurarine chloride of the same activity per c.c. as the Squibb preparation, but containing 3 milligrams per c.c.

Curare should not be given to anyone with weakness of the throat muscles (myasthenia gravis), and intravenous doses larger than 1 to 1½ c.c. should not be given without apparatus available for artificial respiration.

FLORENCE JOHNSTON, M.D.

CEDAR RAPIDS, IOWA
APRIL 7, 1947

Items

American Congress on Obstetrics and Gynecology

Three panel-type morning sessions on the following subjects have been arranged:

1. *Anesthesia and Analgesia*, Tuesday, September 9, Dr. Nicholas J. Eastman, Chairman, with the cooperation of Dr. J. P. Greenhill, Chicago; Dr. John Adriani, New Orleans; Dr. Stuart Cullen, Iowa City; and Dr. Arthur Baptisti, Hagerstown.

2. *Cancer*, Wednesday, September 10, Dr. Robert A. Kimbrough, Philadelphia, Chairman, with the cooperation of Dr. John Randall, Iowa City; Dr. Charles L. Martin, Dallas; Dr. Joe V. Meigs, Boston; and Dr. Herbert Schmitz, Chicago.

3. *Cesarean Section* on Thursday, September 11, Dr. Edward Schumann, Philadelphia, Chairman, with the cooperation of Dr. Edward G. Waters, Jersey City; Dr. Edward Davis, Chicago; Dr. E. D. Plass, Iowa City; and Dr. William Benbow Thompson, Hollywood.

The afternoon meetings of the Medical Section of the Congress will consider the Psychosomatic Aspects of Pregnancy on Tuesday; Pregnancy Complicated by Heart Disease, Diabetes, and Tuberculosis on Wednesday; and Recent Advances in Endocrinology on Thursday.

Round table discussions from 4:00 to 5:00 P.M. daily will consider such topics as abortions, asphyxia, fibroids, prolonged labor, infertility, early ambulation, uterine bleeding, nutrition in pregnancy, endometriosis, the Rh factor, erythroblastosis, geriatric gynecology, and other pathologic conditions relating to obstetrics and gynecology.

Concurrent round table sessions will be held for nurses, hospital administrators, and public health workers.

A scientific and educational exhibit under the direction of Dr. J. P. Pratt of Detroit and a comprehensive motion picture program under the guidance of Dr. John Parks of Washington are in process of development. Those wishing to make applications for space in these exhibits, especially for time on the cinema program, are urged to make early application. Necessary blanks may be obtained from the office of the Congress, 24 West Ohio Street, Chicago 10, Illinois. Better hurry!

On Friday, the last day of the Congress, the entire morning will be given over to the program of the National Federation of Obstetric-Gynecologic Societies. Dr. James S. Taylor of Altoona is arranging this session.

American Board of Obstetrics and Gynecology, Inc.

Examinations

The general oral and pathology examinations (Part II) for all candidates will be conducted at Pittsburgh, Pa., by the entire Board from Sunday, June 1, through Saturday, June 7, 1947. The Hotel William Penn in Pittsburgh will be the headquarters for the Board. Formal notice of the exact time of each candidate's examination will be sent him several weeks in advance of the examination dates. Hotel reservations may be made by writing direct to the Hotel William Penn.

Candidates in Military or Naval Service are requested to keep the Secretary's Office informed of any change in address.

Applications are now being received for the 1948 examinations. For further information and application blanks address Paul Titus, M.D., Secretary, 1015 Highland Building, Pittsburgh 6, Pa.

PAUL TITUS, M.D.

The following newly certified physicians are included in the list of diplomates of the American Board of Obstetrics and Gynecology: Dr. Carl Samuel Bickel, Central Union Bldg., Wheeling, West Virginia; Dr. Elmer M. Broen, 313 Bernard Ave., Richland, Washington; Dr. Carl Rex Moe, 316 Henrietta Street, Kalamazoo, Michigan.

University of California Medical School Postgraduate Courses

The University of California Medical School, in association with University Extension, University of California, announces a course in the applications of nuclear physics to the biological and medical sciences to be given at the Medical Center, in San Francisco, from June 30 through July 18, 1947. It will consist of didactic lectures, laboratory demonstrations, and seminars for round-table discussions, and will be open to individuals in the fields of medical and biological research.

Requests for detailed information to be addressed to Stacy R. Mettier, M.D., Head of Postgraduate Instruction, Medical Extension, University of California Medical Center, San Francisco 22, California.

STACY R. METTIER, M.D.

The University of California Medical School, in association with the Medical Extension, announces the following postgraduate courses:

1. Course in gynecological and obstetrical pathology, and in smear technique as it pertains to cancer of the uterus, stomach, urinary tract, and lungs: August 4 to 15, inclusive, 1947, daily at 9:00 A.M. to 4:30 P.M.

NOTE: This course is limited to 75; registrants are to furnish their own microscopes, of good quality.

Either the morning or the afternoon sessions may be taken, alone or together. It is suggested that experience with the microscope and in cancer diagnosis in general will be an essential prerequisite if one is to obtain proficiency and confidence in the judgment of the smear preparations.

This course is designed to fulfill two needs: (a) requests from physicians who wish to prepare for the American Board Examinations, and (b) requests from pathologists, cytologists, researchers, and all others who are interested in learning to use the smear technique for the diagnosis of cancer in various parts of the body.

2. Obstetrics and gynecology: September 1 to 5, 1947, at 9:00 A.M. to 1:00 P.M., and 2:00 to 5:00 P.M.

American Gynecological Society Meeting

The American Gynecological Society will hold its meeting at the Seigniory Club, Montebello, Quebec, on June 16 to 19, 1947. This announcement was omitted in the April issue of the Roster.

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